Dominion Energy South Carolina: Demand-Side Management (DSM) Potential Study Report

FINAL REPORT

January 27, 2023

Submitted to:
Dominion Energy South Carolina

Submitted by:
ICF Resources, LLC
9300 Lee Highway
Fairfax, Virginia 22031

TABLE OF CONTENTS

TABLE OF CONTENTS ..... **I**
LIST OF FIGURES ..... **III**
LIST OF TABLES ..... **IV**
EXECUTIVE SUMMARY **5**
Energy Efficiency 5
Demand Response 7
1 INTRODUCTION **8**
1.1 Purposes and Uses of Forecasts 8
1.2 Stakeholder Engagement 8
1.3 Organization of the Report 9
2 ENERGY EFFICIENCY (EE) POTENTIAL **10**
2.1 Overview 10
2.2 EE Program Types and Definitions 12
2.2.1 Residential Programs 12
2.2.2 C&I Programs 13
2.3 Data Collection 13
2.3.1 Baseline Market Characterization 13
2.3.2 Utility, Measure, and Program Data 13
2.3.3 Measure Database 15
2.3.4 Eligible Stock 16
2.4 Program Modeling 17
2.4.1 Elements of Analysis 17
2.4.2 Measure Screening and Benefit/Cost Analysis 18
2.4.3 Scenario Definition and Development 19
2.4.4 Potential Assessment Approach 21
2.5 Technical and Economic Potential Results 22
2.6 Achievable Potential Results 23
2.6.1 Overall Portfolio 23
2.6.2 Residential Programs 26
2.6.3 C&I Programs 28
2.7 Commission-Required Forecasts 29
2.7.1 Overall Results 30
2.7.2 Residential Results 32
2.7.3 C&I Results 34

2.8 Key Findings 35
3 DEMAND RESPONSE (DR) POTENTIAL 37
3.1 Overview 37
3.2 DR Program Types and Definitions 38
3.2.1 Program Types Modeled 38
3.2.2 Program Definitions 39
3.3 Data Collection 40
3.3.1 Utility System Data 40
3.3.2 Measure and Program Data 40
3.4 Program Modeling 43
3.4.1 Elements of Analysis 43
3.4.2 Scenario Definition and Development 44
3.4.3 Potential Assessment Approach 44
3.5 Pre-achievable Cost-effectiveness Screening 47
3.6 Achievable Potential Results 48
3.6.1 Overall Portfolio Results 48
3.6.2 Residential Results 50
3.6.3 C&I Results 51
3.6.4 Opt-Out Results 53
3.7 Key Findings 55
APPENDICES 56
A. Energy Efficiency: Measure Assumptions 56
B. Energy Efficiency: Technical and Economic Potential Results 56
C. Energy Efficiency: Achievable Potential Results 56
D. Energy Efficiency: Commission-Required Forecast Results 56
E. Demand Response: Opt-in Results 56
F. Demand Response: Opt-out Results 56
G. Demand Response: Stand-Alone Maximum Achievable Results 57
H. Avoided Costs 57
I. Demand Response: Additional Assumptions 58

LIST OF FIGURES

Figure 1: Overview of Bottom-up Approach to Potential Study 10
Figure 2: Comparison of Gross Incremental Energy Savings and DESC Sales 23
Figure 3: Annual Incremental Energy Savings (GWh) for Achievable Potential Scenarios by Sector 24
Figure 4: Annual Incremental Demand Savings (MW) for Achievable Potential Scenarios by Sector 24
Figure 5: Annual Program Costs ($Millions) by Sector 25
Figure 6: Annual Incremental Energy Savings (GWh) by Residential Program 26
Figure 7: Annual Incremental Demand Savings (MW) by Residential Program 26
Figure 8: Annual Residential Program Costs by Program 27
Figure 9: Annual Incremental Energy Savings (GWh) by Commercial Program 28
Figure 10: Annual Incremental Demand Savings (MW) by Commercial Program 28
Figure 11: Annual Commercial Program Costs 29
Figure 12: Annual Incremental Energy Savings (GWh) by Sector 30
Figure 13: Annual Incremental Demand Savings (MW) by Sector 30
Figure 14: Annual Program Costs ($Millions) by Sector 31
Figure 15: Cost-Effectiveness by Sector 31
Figure 16: Annual Incremental Energy Savings (GWh) by Residential Program 32
Figure 17: Annual Incremental Demand Savings (MW) by Residential Program 32
Figure 18: Annual Residential Program Costs by Program 33
Figure 19: Annual Incremental Energy Savings (GWh) by Commercial Program 34
Figure 20: Annual Incremental Demand Savings (MW) by Commercial Program 34
Figure 21: Annual Commercial Program Costs 35
Figure 22: Summary of ICF's Approach to DR Achievable Potential Modeling 37
Figure 23: Demand Response Program Hierarchy Assumption 44
Figure 24: Potential Assessment Process Flow 45
Figure 25: ICF Direct Load Control Module 45
Figure 26: ICF Time of Use Rate Evaluate Tool (ToURET) Module 45
Figure 27: Program Participation Process Flow 45
Figure 28: Participation Inputs 46
Figure 29: A Sample Bass Diffusion Curve for Participation Estimation 46
Figure 30: Savings Across the Study Period, by Scenario 48
Figure 31: Percentage Winter MW Peak Savings Split by Sector & Scenario for 2037 48
Figure 32: Baseline and Savings Split by Sector & Scenario for 2037 49
Figure 33: Annual Program Costs Split by Sector for Achievable Reference Scenario 49
Figure 34: Residential Winter MW Peak Savings for selected years, by Program and Scenario 50
Figure 35: Residential Achievable Reference Case Annual Costs for Select Years 50
Figure 36:Commercial and Industrial Winter MW Peak Savings for selected years, by Program and Scenario 51
Figure 37: C&I Achievable Reference Case Annual Costs for Select Years 52
Figure 38: Savings Across the Study Period, by Scenario 53
Figure 39: Percentage Winter MW Peak Savings Split by Sector & Scenario for 2037 53
Figure 40: Baseline and Savings Split by Sector & Scenario for 2037 54
Figure 41: Annual Program Costs Split by Sector for Achievable Reference Scenario 54
Figure 42: Residential Winter MW Peak Savings for selected years, by Program and Scenario 54
Figure 43: Commercial and Industrial Winter MW Peak Savings for selected years, by Program and Scenario 55

LIST OF TABLES

Table 1: Comparison of Gross and Net Savings for Achievable Potential Scenarios....6
Table 2: Overview of Study Data Sources....14
Table 3: Illustrative Characteristics of Measures....16
Table 4: Illustrative Measure Eligible Stock Calculation (Water Heater Blanket)....17
Table 5: Number of Measures Tested for Cost-Effectiveness and Included in the Analysis....18
Table 6: Key Assumptions/Revisions to Develop Medium Case....19
Table 7: Summary of Technical and Economic Potential Results for 2023-2037....23
Table 8: Cost-Effectiveness by Sector....25
Table 9: Residential Program Cost-Effectiveness (TRC)....27
Table 10: C&I Program Cost-Effectiveness (TRC)....29
Table 11: Residential Program Cost-Effectiveness (TRC)....33
Table 12: C&I Program Cost-Effectiveness (TRC)....35
Table 13. List of DR Programs Modeled....38
Table 14: Peak Reduction Inputs for Demand Response Modeling....40
Table 15: Participation Inputs - Maximum Market Share for Bass Diffusion Curve for Demand Response Modeling....41
Table 16: Demand Response Modeling - Rate Inputs....42
Table 17. Pre-achievable Cost-effectiveness Screening Results....47
Table 18: Residential Achievable Reference Case Cost-Effectiveness Ratios and Levelized Costs 51
Table 19: C&I Achievable Reference Case Cost-Effectiveness Ratios and Levelized Costs....52

EXECUTIVE SUMMARY

ICF was retained by Dominion Energy South Carolina, Inc. (DESC) to conduct a comprehensive demand side management potential study to focus on cost-effective energy efficiency programs with an emphasis on decreasing the winter peak. The potential study evaluated the technical, economic and achievable potential of energy efficiency in the DESC service area and resulted in a 15-year forecast with three scenarios Low, Medium and High cases of DSM to be used in its 2023 Integrated Resource Plan. In addition to energy efficiency, ICF completed an assessment of demand response programs for DESC to consider once the full installation of AMI is completed within the DESC service territory.

DESC's last DSM Potential Study was concluded and approved in 2019 by the Public Service Commission of South Carolina, under Docket No. 2019-239-E. In the associated Order, the Commission approved DESC's existing portfolio of programs for five (5) years or through Program Year 14 which will end November 30, 2024. The five-year individual program design outputs from this current study will be developed with stakeholder input in 2023 and will be submitted to the Commission for the next set of program revisions and/or plans for implementation in Program Years 15-19 (estimated to be December 1, 2024 – November 30, 2029).

A bottom-up process was used to determine the 15-year maximum achievable energy efficiency potential forecasts for the 2023–2037 period. Included in these forecasts are ten energy efficiency programs covering the residential, commercial, and industrial sectors under current programs and revised scenarios.

While the process for conducting this study remains similar to the previous potential study, and those done elsewhere, some of the inputs vary significantly from the previous potential study. Most notably, a more robust market study was conducted as well as additional utility benchmarking. Further, measure characterization information was updated based on any market changes and additional EM&V that has taken place since the previous potential study completed. Some of the most significant impacts across these inputs are affected by labor market changes, supply chain issues, and overall customer prioritization of energy efficiency. Additionally, DESC and ICF have incorporated stakeholder feedback provided at numerous times into the analysis.

Energy Efficiency

The bottom-up analysis began with collecting data on all relevant inputs, including baseline data, measure data, and program data. ICF developed parameters to characterize typical costs, savings, and lifetimes for all of the energy efficiency measures. This was followed by estimating the eligible stock of energy efficiency measures based on available data for the number and types of buildings and baseline and upgrade measure saturation in DESC's service territory.

At this juncture, ICF was able to estimate the **Technical Potential**; the level of energy and demand savings that would result from installing the most technically efficient measures available for each end-use, regardless of cost. Next, ICF generated an estimate of the **Economic Potential**. An economic screening process based on the Total Resource Cost (TRC) test was used to assess cost-effectiveness and filter out any measures with a TRC below 1. In order to account for changing economics over time, the cost-effectiveness of each measure was assessed for each year of the forecast period.

With the eligible stock and cost-effective measures defined, ICF then conducted the **Achievable Potential** analysis. This required developing savings forecasts for demand-side management (DSM) programs for the 15-year period under three scenarios that were defined using stakeholder input:

1. **Medium case** achievable potential scenario based on current DESC performance and spending in the latest evaluated program year while accounting for influences outside of the utility's control (e.g., COVID-19 disruptions) and continuing the existing DSM portfolio of programs and marketing plans with modifications to participation based on the ODC market study, utility benchmarking and the revised measures as identified in the 2023 Potential Study.

2. **High case** maximum achievable potential scenario assumes the Company achieves amount of energy use that efficiency can realistically be expected to displace assuming the most aggressive program scenario possible. This includes expanding existing programs based on the detailed benchmarking of program performance of other comparable utility funded programs; and

3. **Low case** achievable potential scenario is based on a 10% reduction in the savings from the Medium case. The Low case assumes that the Company achieves 90% of the levels described in the Medium case should unforeseen events occur (i.e., global pandemic, economic recession, waning of customer interest).

During this study, there were multiple points for stakeholder engagement through DESC's Energy Efficiency Advisory Group (EEAG), which included both live meetings and addressing written feedback. All collected feedback was addressed to finalize the forecasts.

Key findings from the EE potential study are as follows:

- In the Medium case, annual incremental savings in 2024 represent 0.39% of 2021 sales and these savings decrease slightly throughout the study period as the opportunity for energy efficiency is reduced. Savings in the High case are about 44% higher in 2024, representing 0.57% of 2021 sales.

Table 1: Comparison of Gross and Net Savings for Achievable Potential Scenarios[1]

	Medium Case	High Case	Low Case
Net Savings % of 2021 Sales (Excl Opt-Out)	0.39%	0.57%	0.35%
Gross Savings % of 2021 Sales (Excl Opt-Out)	0.51%	0.74%	0.46%

- In terms of Residential sector programs, the Home Energy Report program provides the largest savings opportunity, replacing lighting across several different program as the most important savings type. The Heating, Cooling, and Water Heating program is the second largest contributor to savings. High case programs could increase residential sector savings by about 40% above the Medium case.

- In terms of Commercial and Industrial (C&I) sector programs, the Energy Wise for Your Business program accounts for the majority of the savings and the Municipal Lighting program only contributes early in the study since it is anticipated that this program will be ramped down by 2025. High case programs could increase C&I sector savings by about 49% above the Medium case.

- The combined portfolio of residential, commercial, and industrial programs has a TRC ratio of 1.28 in the Medium case, 1.14 in the High case, and 1.24 in the Low case. These values are representative of the entire study period (i.e., 2023-2037).

Following the development of the High case, ICF developed **Commission-required scenarios** that go beyond the High case maximum achievable potential based on energy savings levels of 1%, 1.25%, 1.5%, 1.75%, and 2% of 2021 sales. These results and the assumptions used to develop these scenarios were shared with the EEAG prior to the filing of the 2023 IRP. The Commission-required forecasts represent a minimum 77% increase above the High case. Additionally, these forecasts require participation that is

[1] For comparison purposes, Net and Gross savings have been provided in this Table. Figures presented in the rest of the report represent Net savings, while Gross savings information is provided in the files in the Appendices. In addition, the benchmark against DESC's 2021 sales excludes opt-out customers.

beyond the maximum that can be reasonably achieved through DESC's DSM programs and include measures and/or programs that are not cost-effective.

Demand Response

ICF completed a comprehensive evaluation of demand response programs for residential, commercial, and industrial customers with an emphasis on decreasing the winter peak. The analysis was presented in aggregate, as well as by sector, primarily for the opt-in mode of delivery. Additionally, an opt-out mode was considered for the time of use program. DESC notes that while the analysis was comprehensive, industry recommended practice may counsel toward more selectivity in program implementation.

A bottom-up approach was used to evaluate DR potential for DESC. Three primary achievable scenarios were analyzed for the study: (1) the **Reference** case that assumes expected reasonable levels of participation, with maximum market shares coming from the ODC study; (2) the **Low** case that sets participation estimates to a conservative estimate to provide a lower bound on the achievable potential when all cost-effective programs are implemented; and (3) the **High** case that assumes aggressive marketing and implementation strategies to achieve higher participation levels

The analysis began with the development of a comprehensive list of DR program types currently implemented in U.S. markets, and then filtering out the ones applicable to the DESC territory. The data required to model and evaluate the parameters for different programs were then collected, such as implementation costs, market size, and participation criteria. Data sources include DESC data; publicly available data, such as potential studies and annual reports; and ICF expert input. This information was then run through the ICF Demand Response models to evaluate savings and cost-effectiveness.

This study provides the potential DESC winter peak impact due to existing and new DR programs, along with the details of savings forecasted for every year of the analysis, annual program costs, and program benefit-cost results.

Key findings from the DR potential study, for the scenario where all programs are rolled out as opt-in, are as follows:

- Demand response programs have the potential to shave ~10% of the peak load, by 2037, in the reference case. This numbers goes up to 13% in the high case and can dip down to 9% in the low case. The corresponding MW savings are 486 MW, 653 MW and 432 MW for the reference, high and low cases.

- Existing programs - interruptible and backup generation - contribute to 47% of the total savings even in 2037. In 2037, 39% of savings are achieved from the interruptible program, 8% of savings are achieved from the backup generation program, in the reference case.

- Among the new programs, smart thermostat, time of use and peak time rebates are the highest contributors. In 2037, in the reference case, these three programs contribute to 15%, 13% and 9% of the total savings estimated from the demand response programs.

- Smart thermostats contribute 34% of the overall residential savings, followed by 28% from the time of use residential program. In the reference case, the contributions from the other programs (i.e., peak time rebate, critical peak pricing and demand rate stand at 19%, 12% and 7%, respectively)

- Interruptible program contributes to 72% of the total C&I savings, followed by the backup generation program that contributes to 15%. All the other programs have single digit percentage contributions adding up to 13%.

- The portfolio level cost-effectiveness {i.e., TRC is 7.9 over a 15-year period). In all sectors, all programs except the real-time pricing have TRC benefit-cost ratios greater than 1 in all cases.

1 INTRODUCTION

1.1 Purposes and Uses of Forecasts

ICF was retained by Dominion Energy South Carolina, Inc. (DESC) to conduct a demand side management potential study resulting in a 15-year forecast and a 5-year achievable cost-effective program plan. The study focuses on cost effective demand side management and energy efficiency programs with an emphasis on decreasing the winter peak. The DSM Potential Study process kicked off with a market characterization study conducted by Opinion Dynamics Corporation (ODC) beginning in August 2021. Using the ODC inputs, ICF began a scoping and input process with the DESC Energy Efficiency Advisory Group (EEAG) in February 2022. Once the achievable potential scenarios were complete, ICF developed the budget, energy, and demand forecasts for these scenarios, along with the cost effectiveness results.

The 15-year forecast utilizes the market data collected by ODC and enables DESC to fully understand their market for demand side management through energy efficiency. The 5-year program design outputs from this study will enable DESC to develop individual program plans for submission to the Commission for the next set of program revisions and/or plans for implementation in Program Years (PY) 15-19 (estimated to be December 1, 2024 – November 30, 2029).

1.2 Stakeholder Engagement

The Energy Efficiency Advisory Group (EEAG) is a forum for DESC to solicit feedback directly from stakeholders and collaborate around the design, implementation, evaluation, and performance of the DESC DSM programs. For this Study, the EEAG stakeholder engagement process ran from April 2021 through November 2022 and involved extensive participant interaction and input. The timeline for the EEAG stakeholder engagement, including meetings (highlighted in blue) and major updates provided, was as follows:

- April 2021: ICF Potential Study Scope of Work Input Meeting with Stakeholders
- July 2021: Review of Draft Opinion Dynamics Market Assessment Scope of Work
- August 2021: Opinion Dynamics Market Assessment Begins
- November 2021: Market Study Update and ICF Decision for Potential Study
- February 2022: Market Study Update and ICF Modeling and Forecasting Scope, Scenario Definitions
- April 2022: ODC Market Residential Characterization Study Update, Potential Study Update and Feedback on EE and DR Measures Requested
- June 23, 2022: ODC Commercial Market Characterization Study Update, EE Profile Development Meeting, and Measure List Discussion with Stakeholders
- June 29, 2022: Special Meeting to Address PSC Order to Address Stakeholder Recommendations
- August 25, 2022: Potential Study Economic/Technical Potential Results Shared, ODC PY11 EM&V Results and Program Specific Recommendations
- September 7, 2022: Measure Characterization Workbooks Sent for Stakeholder Feedback
- October 13, 2022: End Use Profiles Details Shared
- October 20, 2022: Meeting to Address Measure Characterization Questions and Potential Study Update and Results Shared
- November 16, 2022: Draft of Potential Study Final Results Shared
- November 18, 2022: Walk-through of Draft Potential Study Final Results
- December 29, 2022: Response to Stakeholder Potential Study results and Higher Case EE Scenarios (1-2%) Shared with Stakeholders

Throughout the process and using both email and a shared web portal, DESC responded to extensive stakeholder feedback related to all aspects of the study, including but not limited to feedback on the scope of work for ICF, measure input assumptions (e.g., savings, costs, penetration, etc.), scenario definitions, energy costs, preferred load shapes, and cost-effectiveness assessment.

1.3 Organization of the Report

The balance of the report contains explanations of the data inputs and analytic methodologies used to forecast results from applying those inputs and methodologies and key findings. The EE program potential is described first, followed by the DR program potential. The descriptions are divided into these main sections:

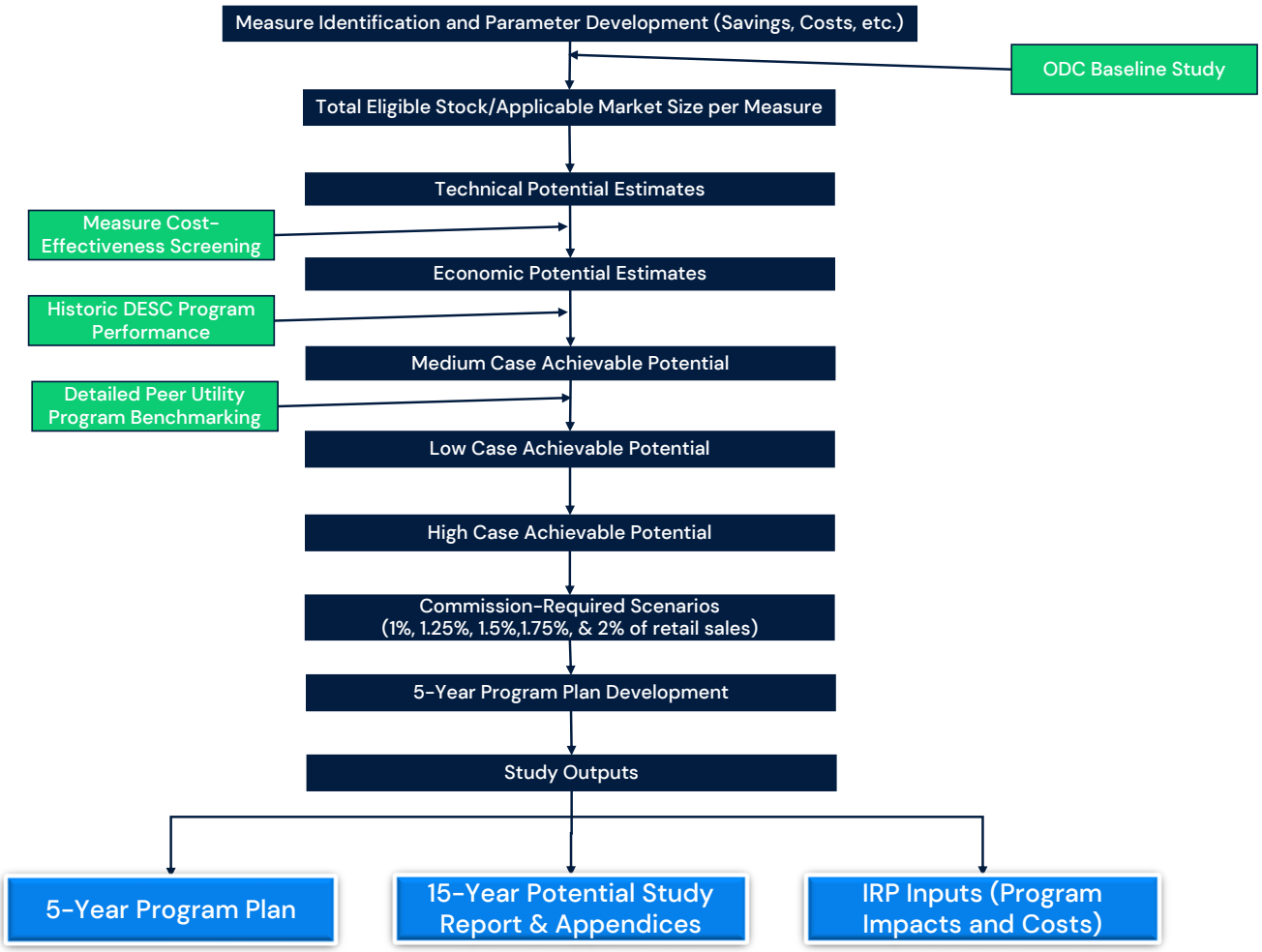
- Overview
- Program Types and Definitions
- Data Collection
- Program Modeling
- Achievable Potential Results
- Key Findings

2 ENERGY EFFICIENCY (EE) POTENTIAL

2.1 Overview

Figure 1 provides a high-level overview of ICF's bottom-up approach to this study.

Figure 1: Overview of Bottom-up Approach to Potential Study[2]



The bottom-up analysis began with collecting data on all relevant inputs, including baseline data, measure data, and program data. Once the list of energy efficiency measures was finalized, ICF proceeded with the measure characterization, developing parameters to characterize typical costs, savings, and lifetimes. In addition to impacts on electricity consumption, water savings, natural gas savings, and avoided and deferred equipment replacement costs were estimated where applicable. For instance, water savings were included for water usage reducing measures, such as low-flow showerheads, while natural gas savings were included for measures, such as insulation and air sealing, installed in gas-heated buildings.

[2] The five-year individual program design outputs from this current study will be developed with stakeholder input in 2023 and will be submitted to the Commission for the next set of program revisions and/or plans for implementation in Program Years 15-19 (estimated to be December 1, 2024 – November 30, 2029).

Avoided and deferred equipment replacement cost savings were included for measures that have a longer estimated useful life than the technologies they are replacing. The longer lifetime means that the measure will require fewer replacements.

This was followed by estimating the eligible stock of energy efficiency measures. The eligible stock is the size of the market for efficiency measures, in measure units, such as bulbs, tons of cooling, or number of homes. ICF estimated the eligible stock for measures within each end-use and sector. This task required data on the number on customer types in DESC's service area, the number and types of buildings, the types of energy-using equipment that are in each building type, and the current saturation of baseline and energy-efficient equipment.

At this juncture, ICF was able to estimate the **Technical Potential**; the level of energy and demand savings that would result from installing the most technically efficient measures available for each end-use, regardless of cost. This represents the upper bound of how much electricity consumption could theoretically be reduced. To calculate the technical potential, ICF used its Demand Side Resource Potential Model (DSRPM), an Excel-based model that applies an industry-standard, bottom-up approach to estimate DSM potential based on stock turnover. When estimating technical potential, the measure with the highest total savings for a given baseline opportunity were selected. Separate models were constructed for each sector: residential, commercial and industrial.

Next, ICF generated an estimate of the **Economic Potential**. An economic screening process based on the Total Resource Cost (TRC) test was used to assess cost-effectiveness and filter out any measures with a TRC below 1. In order to account for changing economics over time, the cost-effectiveness of each measure was assessed for each year of the forecast period. Therefore, if a measure was not economic in the initial years of the forecast but was anticipated to have a significant reduction in capital costs in later years of the forecast, the measure was included in the economic potential once it was cost-effective. Each economic potential estimate was based on the most efficient, cost-effective measure available for a given baseline opportunity.

With the eligible stock and cost-effective measures defined, ICF then conducted the **Achievable Potential** analysis. This required developing savings forecasts for demand-side management (DSM) programs for the 2023-2037 period under three scenarios that were defined using stakeholder input:

1. **Medium case** achievable potential scenario based on current DESC performance and spending in the latest evaluated program year while accounting for influences outside of the utility's control (e.g., COVID-19 disruptions) and continuing the existing DSM portfolio of programs and marketing plans with modifications to participation based on the ODC market study, utility benchmarking and the revised measures as identified in the 2023 Potential Study

2. **High case (maximum)** achievable potential scenario assumes the Company achieves amount of energy use that efficiency can realistically be expected to displace assuming the most aggressive program scenario possible. This includes expanding existing programs based on the detailed benchmarking of program performance of other comparable utility funded programs; and

3. **Low case** achievable potential scenario based on a 10% reduction in the savings from the Medium case. The Low case assumes that the Company achieves 90% of the levels described in the Medium case should unforeseen events occur (i.e., global pandemic, economic recession, waning of customer interest).

Following the development of the High case, ICF completed a full evaluation of the cost-effectiveness and achievability of the **Commission-required scenarios** that go beyond the High Case maximum achievable potential based on energy savings levels of 1%, 1.25%, 1.5%, 1.75%, and 2% of 2021 sales. These scenarios require participation level beyond what is reasonable for DESC and were modeled by adding in additional measures that were not originally included in the achievable potential scenarios since they were not cost-effective. Program-level benchmarking data was used to estimate the maximum

possible expansion for each program and ICF estimated the impact on program costs using a benchmarking approach.

2.2 EE Program Types and Definitions

ICF modeled the following residential sector and commercial and industrial (C&I) sector programs for this study, as described briefly below.

2.2.1 Residential Programs

- **Appliance Recycling:** Promotes the retirement and recycling of inefficient, working refrigerators and freezers from households by offering incentives and free pick-up and responsible recycling of the equipment.

- **Heating, Cooling, and Water Heating:** Promotes investment in long-term savings by providing rebates to customers for the purchase of new ENERGY STAR® qualified HVAC equipment, heat pump water heaters that replaces older inefficient equipment and duct sealing. The achievable potential forecasts include a greater emphasis on rebates for air-source heat pumps and heat pump water heaters and accounts for upcoming changes to minimum energy performance standards (i.e., baseline of SEER 15 vs. SEER 14).

- **Home Energy Check-up:** Conducts in-home visual energy assessments of all home types to educate customers on home energy consumption and identify opportunities to save energy and money. Direct install measures, including advanced power strips, LED bulbs, and faucet aerators, are installed for free. In addition, water heater and hot water pipe wrap (insulation) are provided to customers with electric water heaters.

    - **Home Energy Check-up Tier 2:** Participants who complete the Home Energy Check-Up+ Program may also can receive incentives under an additional offering, which focuses on building envelope upgrades and includes more comprehensive measures that are identified, such as air sealing and attic insulation. Following an EM&V recommendation, this sub-component was modeled as part of the HEC program and as a standalone program.

- **Home Energy Reports:** This program provides information on energy use to home occupants via home energy reports and an energy portal, encouraging them to reduce their energy consumption. Reports focus on both EE education and actions the customer can take to improve the energy efficiency of their home. The energy portal provides the customer the option to further engage with the program. This information typically includes home energy use for the last month compared with historical energy use, a comparison with the energy use of similar homes, and information on potential energy savings opportunities. This program is based on an opt-out model.

- **Neighborhood Energy Efficiency Program:** Provides energy education, an on-site energy assessment of the dwelling, and direct installation of select energy-saving measures at no additional cost for customers based on qualifying income levels. These are delivered in a door-to-door “sweep” approach to targeted neighborhoods where at least 50% of households have income levels =/< 200% of the poverty guideline as defined by the United States Department of Health and Human Services. The program also includes a mobile homes subset which receives weatherization measures based on the highest average energy users over the most recent 12-month period.

- **Multifamily (Commercial and Residential):** This program provides energy education, an on-site energy survey of the dwelling, and direct installation of select energy-saving measures specific to multifamily customers. In addition, energy efficiency measures are provided to common areas to

include HVAC upgrades, LED lamps and/or fixtures and water conservation measures which will result in incentives for property owners.

- **Online Marketplace:** Incentivizes residential customers to purchase and install high-efficiency ENERGY STAR® LED lighting products, advanced power strips, smart thermostats, smart products and water conservation measures, as well as provides education to increase customer awareness of energy-efficient equipment.

2.2.2 C&I Programs

- **EnergyWise for Your Business:** The program offers incentives to eligible C&I customers to encourage installation of high efficiency equipment and building improvements to improve energy efficiency and reduce electric consumption. The program includes both prescriptive and custom incentives and includes retrofit lighting, new construction lighting, HVAC unitary, HVAC chillers, HVAC variable frequency drives, food service and refrigeration equipment, custom, building tune-up, agricultural custom measures, prescriptive cool roof and technical services. This program also includes incentives to industrial facilities and a strategic energy management component that helps businesses reduce their energy costs with tools, coaching, and technical resources to support energy goals through a year-long series of workshops and one-on-one coaching.

- **Small Business Energy Solutions:** Provides cost-effective, comprehensive retrofit services (lighting, refrigeration, HVAC) to small business customers on a turnkey basis. The program identifies cost-effective efficiency retrofit opportunities and provides the direct installation of measures, financial incentives and other strategies to encourage replacement of existing equipment with high efficiency alternatives. These customers include convenience stores, offices, garages, warehouses, restaurants, and other smaller businesses. The program measures are directly installed for the customers and are primarily lighting and refrigeration.

- **Municipal LED Lighting:** Provides incentives which allow for a financially neutral option for municipalities (Rate 17 customers) to convert their streetlights from older, inefficient technology to LED lighting.

2.3 Data Collection

2.3.1 Baseline Market Characterization

Opinion Dynamics Corporation (ODC) performed the baseline market characterization for both the Residential and Commercial market segments. This included telephone surveys of a large sample of the customer base and a select set of site visits for more detailed and verifiable data.

2.3.2 Utility, Measure, and Program Data

ICF performed several steps to complete the study data collection process. ICF processed some of the data specifically for this study (Table 2), performing engineering calculations and building simulations to develop energy-savings estimates for some measures, as well as processing the data provided into a usable form. ICF experts also informed program participation based on implementation and planning experience. ICF used data on utility characteristics, measure baselines and parameters, and programs using DESC and South Carolina-specific data, where possible. Standard industry sources for the South Atlantic region and national data supplemented the local data. Table 2 presents the data sources for this study.

Table 2: Overview of Study Data Sources

Data/Information Type	Source	Primary Purpose of Study
Utility Data		
Avoided costs	DESC data	Cost-effectiveness testing
Other planning assumptions, such as DESC discount rates, line losses, or growth rates	DESC data	Cost-effectiveness testing
Customer counts (residential, commercial, and industrial)	DESC data	Calculating eligible stock
Load forecast/sales data	DESC data	Calculating load impacts of DSM potential
Retail rates for all rate classes	DESC data	Calculating Participant Cost Test and participation for achievable potential analysis
Baseline Data		
Residential building characteristics and efficiency saturation	Opinion Dynamics Corporation (ODC) Residential Appliance Saturation Surveys (RASS)	Calculating eligible stock
	Residential Energy Consumption Survey (RECS, 2015)	
Commercial building characteristics and efficiency saturation	ODC Commercial Appliance Saturation Survey	Calculating eligible stock
	DESC Commercial Customer Data	
	Commercial Buildings Energy Consumption Survey (CBECS, 2018)	
	SC Department of Natural Resources, Coastal Plain Water Well Inventory	
Industrial subsector characteristics and efficiency saturation	DESC Industrial Customer Consumption Data	Calculating eligible stock
	DESC Industrial Customer Segments based on Standard Industrial Classification	
	Manufacturing Energy Consumption Survey (MECS, 2018)	
Measure Data		
Residential and commercial measure data	DESC Program Evaluation and Tracking Data	Measure database development
	Technical Reference Manuals; including Illinois, Arkansas and Texas	
	Technical Reference Manuals; including Arkansas and DESC Residential TRM Lite	
Industrial measure data	U.S. DOE studies	Measure database development

Data/Information Type	Source	Primary Purpose of Study
	U.S. EPA studies	
	LBNL studies	
	ICF expert knowledge	
Program Data		
ICF program data and expert judgment	ICF	Estimating achievable potential
Historical program savings (evaluation) and cost data	DESC	Calculating eligible stock, Estimating program expenses, Estimating achievable potential
Benchmarking data reviewed	Benchmarking Research, Guidehouse (May 2022)	Benchmark DESC's 2019 and 2020 EE/DSM portfolio amongst peer utilities
	Form EIA-861	Benchmarking of DESC cost performance by sector
	ESource Database	Benchmarking of individual program types to gage potential expansion in cases above Medium.

2.3.3 Measure Database

ICF developed a comprehensive measure database for this study, including commercially available measures covering each relevant savings opportunity within each end-use and sector. The database includes prescriptive or "deemed" type measures, whole building options (e.g., commercial custom and new construction projects), and behavioral measures (e.g., residential home energy reports). Measure end-uses covered include the following:

Residential
- Whole Home
- Refrigeration
- Water heating
- Heating and Cooling
- Lighting

Commercial
- Whole Facility
- Refrigeration
- Water heating
- Heating and Cooling
- Lighting

Industrial
- Heating and Cooling
- Lighting
- Machine drive
- Motor, other applications
- Other process and non-process uses
- Process cooling and refrigeration
- Process heating
- Agriculture/Miscellaneous

Table 3 shows the illustrative characteristics of each measure modeled.

Table 3: Illustrative Characteristics of Measures

Measure Characteristic	Value
1. Applicable sector	Commercial
2. Applicable subsector	N/A
3. Building type	Food Service
4. End-use	Refrigeration
5. Measure name	Night covers for open refrigerated display cases (Coolers)
6. Measure definition	Refrigeration Night Covers - Coolers
7. Baseline definition	Open refrigerated display case without a night cover
8. Measure unit	Per foot of display case
9. Measure delivery type	Retrofit
10. Incremental cost	$42
11. Baseline unit effective useful life	N/A
12. Efficient unit effective useful life (years)	5.0
13. Incremental (annual) kilowatt-hour (kWh) savings	136
14. Incremental kilowatt (kW) savings	0.0

Many measures required permutations for different applications, such as different building types, lamp wattages, efficiency levels, and decision types. For example, there are permutations of central air conditioners by seasonal energy efficiency ratio (SEER) level, subsector, and building type. Descriptions of each measure type and permutation appear in Appendix D as well as measure cost-effectiveness results. The details of the measure characteristics were shared with the EEAG and DESC Program Managers for review and feedback at various stages of the planning process to ensure that measures were updated appropriately for the study.

A key measure baseline change accounted for in this study was a new federal efficiency standard for split HVAC systems. The change increases the baseline from SEER 14 to SEER 15 in 2023. In addition, lighting savings are expected to significantly decrease, or be removed, due to the Energy Independence and Security Act (EISA), 2007.

2.3.4 Eligible Stock

The eligible stock is the size of the market for efficiency measures, in measure units, such as bulbs, tons of cooling, or number of homes. ICF estimated the eligible stock for each measure within each end-use and sector. Key data from the baseline sources noted previously include items such as:

- Percentage of homes with an equipment type (e.g., light bulbs, central AC, refrigerator)
- Equipment counts (e.g., number of bulbs per home, tons of cooling per home, refrigerators per home)
- Equipment efficiency level (e.g., bulb type, SEER rating, ENERGY STAR® rating)
- Equipment age

A simple example of an eligible stock calculation for residential electric water heater blankets is shown in Table 4. This example shows that there are 233,805 water heaters eligible for tank wrap insulation (row h). Because this is a retrofit measure, the eligible stock does not account for stock turnover. Stock turnover is the rate at which existing equipment expires and requires replacement. It is the inverse of equipment age, or 1 divided by the equipment's effective useful life (EUL). If this were a replace-on-burnout Water Heater measure, the eligible stock would equal 1/5 years (1/a) times row h, which equals 46,761 water heater tank wraps wearing out every year and eligible for replacement.

Table 4: Illustrative Measure Eligible Stock Calculation (Water Heater Blanket)

Variable		Value	Source or Calculation
	Measure Name	Water Heater Tank Wrap	
	Measure Baseline	No Water Heater insulation	
a	Baseline unit EUL (years)	5	Illinois TRM
b	All not Multifamily customers	399,258	DESC
c	Homes with electric water heaters (%)	61%	ODC Data
d	Number of measure units per home	1.00	1 water heater unit per home
e	Applicability (% of homes with storage water heaters)	100%	2019 SCE&G Study
f	Efficient unit saturation	4%	ODC Data
g	Not yet adopted rate	96%	100% – f
h	Total eligible stock in 2022 (number of potential WH storage tanks w/o insulation)	233,805	b × c × d × e × g

2.4 Program Modeling

This section provides an overview of how the DESC-specific inputs were turned into program-level economic analysis of the EE programs and forecasts of adoption and energy savings.

2.4.1 Elements of Analysis

The assumptions with respect to the elements of the analysis and the reporting methodology that were made in the study are listed in this section:

- **Peak demand:** Peak demand impacts were evaluated for the winter period as defined as the average electric demand impact from 6-9 am from December 1 through February 28.
- **Economic screening:** All measures were screened for cost-effectiveness with a primary cost-effectiveness test of the TRC test. Measures were included in the achievable potential if they passed the TRC test.
- **Level of savings:** Energy savings reported for EE are all at the generator (i.e., the savings include transmission and distribution losses). Benefits for cost-effectiveness tests are based on product of energy savings and the avoided costs in Appendix H.
- **Low income/income-eligible:** Defined for the purposes of the study consistent with DESC's income-eligible program requirements.[3]
- **Achievable potential:** The amount of energy savings that can realistically be achievable by energy efficiency programs.
- **Program applicability to sub-sectors**:
  - For the residential programs, programs that specify a sub-sector, such as the Multifamily Program, are the only ones able to participate in such a program. These sub-sector programs do not exclude customers from participating in the broader programs, but since the sub-sector specific programs could offer higher incentives, we assume the customers participate in those for all measures they can.
  - For the commercial and industrial programs, like the residential programs, any sub-sector customer is assumed to prioritize participating in sub-sector specific programs but are not excluded from participating in broader programs.

[3] The income qualification for DESC programs is 200% of the federal poverty level.

- **Levelized Cost ($/kWh**): The Levelized Cost is the net present value of the cost of unit energy saved over its lifetime. The costs include all the incentive and non-incentive costs from the UCT test.
- **Fallback:** It was assumed that customers implementing energy efficiency measures as a result of DESC programs would implement the same measures in the future once the existing measures expire but without support from DESC programs.

A note about federal legislation: While the Inflation Reduction Act (IRA) will lead to changes in some aspects of utility economics, it would not be pertinent to attempt to alter the results of this potential study based on speculation about those potential changes. As a practical matter, there is no industry standard percentage or consensus on how to apply any proposed IRA funding to a potential study that would fit the DESC requirements to meet compliance of Commission Order No. 2021-295. To comply with this Order, DESC informed the Commission they would ensure that any new measure and/or program and related forecasts are supported by evaluated data or heavily supported by program experience in a similar service territory. While DESC may be able to take certain aspects of the IRA into account in its IRP, such as the potential for increased uptake in EVs as a result of IRA incentives, it is not practicable or appropriate to make similar assumptions as to the influence of DSM programs on the uptake of the measures contemplated in this potential study.

2.4.2 Measure Screening and Benefit/Cost Analysis

All measures were screened for cost-effectiveness using the measure TRC test.[4] In most cases, only measures with a TRC of 1.0 or higher (in their representative test years) passed to the next stage of the analysis. A measure with a TRC result of 1.0 indicates that the measure is cost-effective on a stand-alone basis (before consideration of program costs or NTG ratios). An exception to this rule for non-economic measure permutations was made when most of the permutations of that measure type were cost-effective. For example, if a measure type was cost-effective for a majority of, but not all, applicable building types, the measure type was included for all building types in the achievable potential analysis. Excluding participation by customers in specific building types can be impractical from a program implementation perspective.

ICF also applied the converse principal in a small number of cases. For example, if a measure was cost-effective for a minority of building types, ICF excluded all permutations of the measure in the achievable potential analysis, because it can be impractical in implementation to limit participation to certain building types.

Table 5 shows the number of measures evaluated for cost-effectiveness and the number that were economic. About 70% of the measures evaluated were found to be economic and were therefore included in energy efficiency programs.

Table 5: Number of Measures Tested for Cost-Effectiveness and Included in the Analysis

Sector	Measure Types Tested for Cost-Effectiveness	Measure Permutations Tested for Cost-Effectiveness	Measure Types Passing Cost-Effectiveness Screening (Included in Analysis)	Measure Permutations Passing Cost-Effectiveness Screening (Included in Analysis)
Residential	106	305	61	131
Commercial	97	1463	67	743
Industrial	93	644	69	478
TOTAL	**454**	**1,442**	**320**	**1,032**

[4] Measure TRC benefits include avoided energy costs, avoided capacity costs, natural gas savings, and non-energy benefits over the lifetime of the measure. Measure TRC costs are measure incremental costs; these include the difference in equipment and labor costs between the efficient and baseline units.

For the purposes of evaluating cost-effectiveness, DESC uses a difference in revenue requirements methodology to calculate both the energy component and the capacity component of its avoided costs. This approach involves calculating the revenue requirements between a base case and a change case.

For the avoided energy cost calculation, the base case is defined by DESC's existing fleet of generators plus any projected future generators, as well as the solar facilities with which DESC has executed a power purchase agreement. The change case is the same as the base case except that the hourly loads are reduced by a 100 MW EE profile. The avoided energy cost is simply the difference between the base case costs and the change case costs. For the purposes of this calculation, a value of $0.0511 per kWh (in 2022 dollars) was used, followed by the application of an 9.25% average line-loss factor. The avoided costs that were used in the study are included in Appendix H.

Following stakeholder input, ICF modified the planning model to allow for 12 different avoided energy costs ($/kWh) to be used that would be assigned on a measure-by-measure basis. Using National Renewable Energy Lab (NREL) end-use load profiles, ICF provided DESC with 6 residential 8760 load shapes and 6 non-residential 8760 load shapes. All NREL end-use profiles were from Weather IECC Zone 3-A which primarily covers the DESC service territory. These load shapes were inputted into PLEXOS and modeled as a resource to develop the avoided energy costs, which were then applied in the potential study on an end-use basis. Based on this analysis, DESC then provided ICF with the end use level avoided energy costs.

For the avoided capacity cost calculation, the analysis was modified for winter capacity savings. A resource plan populated with internal combustion turbines (ICT) was used. DESC calculated the incremental capital investment related revenue required to support the ICT resource plan. DESC derived a change case in its resource plan by adding a 100 MW purchase then adjusting the expansion plan accordingly. The difference in the revenue requirement between the base case and the change case defined the avoided capacity cost.

2.4.3 Scenario Definition and Development

ICF forecasted achievable energy efficiency potential for the above programs under three scenarios: 1) the Medium case achievable potential scenario; 2) the High case (maximum) achievable potential scenario, and; 3) the Low case achievable potential scenario. All three scenarios represent *cost-effective, reasonable and achievable* levels of DSM, as directed by the Commission.[5] Table 6 summarizes the key assumptions and revisions that were made to each program.

Table 6: Key Assumptions/Revisions to Develop Medium Case

Program	Key Differences from Existing Programs to Medium Case
Appliance Recycling	Increased participation, increased implementation fees to reflect market prices, updated NTG ratio
Heating, Cooling, and Water Heating	Increased participation for HPWH and ASHP measures, removed measures that were not cost-effective (e.g., AC rebates)
Home Energy Checkup – Tier 1	Increased participation and direct installation of non-lighting measures, phase out installation of direct install LEDs after 2027
Home Energy Checkup – Tier 2	Considered program component separately
Home Energy Report	Opt-out program, aligned savings based on EM&V recommendations
Multifamily	Increased participation, phases out installation of direct install screw-base LEDs after 2027

[5] Docket No 2019-226-E – Order No. 2021-429

Program	Key Differences from Existing Programs to Medium Case
Neighborhood Energy Efficiency Program	Adjusted participation to achievable levels vs rapid assessment, increased implementation expenses to reflect market prices and increases cost of measures, phase out installation of direct install LEDs after 2027
Online Marketplace	Increased smart thermostats and other non-lighting measures, phased out sale of LEDs after mid-2023, implementation expenses increased to reflect market prices, cost of measures
Energy Wise for Your Business	Adjusted participation to achievable levels vs rapid assessment
Small Business Energy Solutions	Adjusted participation to achievable levels vs rapid assessment, implementation expenses and incentives increased to reflect market prices
Municipal LED Lighting	Phased out installation of LED streetlights after 2025

Following the development of the High case, ICF developed Commission-required achievable potential scenarios that go beyond the maximum achievable potential and are based on energy savings levels of 1%, 1.25%, 1.5%, 1.75%, and 2% of 2021 sales. To be able to start this process, ICF had to complete the 2023 DSM Potential Study and determine the levels for achievable and maximum achievable potential scenarios. Due to the Commission-required scenarios being higher than the maximum achievable scenario, the maximum achievable was used as the baseline. The process for developing the incremental higher cases from 1.00% to 2.00% started by adding in measures with a measure-level TRC cutoff of 0.40. These measures were not originally included in the achievable potential scenarios since they were not cost-effective. There were a few cases of measures with TRC values below 0.4 being added to the Commission-required scenarios but those were only included for exempt programs (i.e., low income) and in the case of other similar measures falling above the threshold and already having been included.

Once the additional measures were included, the programs were benchmarked against similar programs within similar regions (e.g., Duke Energy, Georgia Power, Entergy Mississippi), as outlined in more detail in Section 2.4.4.1. Program participation data was obtained from ESource for utilities based on similar region, climate, and utility size. Program-level benchmarking data was used to estimate the maximum possible expansion for each program. However, all of these scenarios represent savings that are beyond the maximum (High) scenario achievable potential results, meaning that the Commission-required forecasts require participation that is beyond the maximum that can be reasonably achieved through DESC's DSM programs.

Next, ICF estimated the impact on program costs. This was done based on benchmarking of portfolio costs for residential and C&I programs separately. The benchmarking was done based on $/kWh in order to control for portfolio size, but the utilities used for the benchmarking were limited to those of similar size and region as DESC. Additional details on the benchmarking approach are provided below.

Assumptions about customer preferences and decision-making criteria, utility assumptions (e.g., avoided costs, discount rates), and exogenous economic factors (e.g., growth, inflation) were all held constant for all scenarios.[6]

[6] One reason that these factors are held constant in ICF's model is that ICF's DSM forecasts are used as inputs to DESC's integrated resource planning model, which is a dynamic model that varies utility, macroeconomic, and other assumptions.

2.4.4 Potential Assessment Approach

This section describes how ICF developed key assumptions for programs, including program costs and participation rates.

2.4.4.1 Benchmarking

Benchmarking was used in several manners in the assessment of the achievable potential scenarios and the development of the commission-required forecasts. The primary use of the benchmarking was to adjust the participation and costs, most notably in the expanded cases. The primary source of data used for benchmarking was from other comparable utilities in the Southeast. ICF accounted for mandatory energy efficiency resource standards, service area size, customer base, and climate in the analysis of the benchmarking data. In addition, the analysis included controls for the difference in utility size and weather. By focusing on comparable areas, the analysis was better able to control for similarities in housing stock, economics, and other external factors that impact program performance. Additionally, this supports DESC efforts to comply with Order No. 2021-295.

In evaluating the potential expansion of participation, program-level data was used to evaluate the current savings from DESC programs and how much the programs could be expanded. The data used was primarily accessed from the ESource database.

In determining the cost impacts of the program expansions, portfolio-level data was used to develop separate cost curves for each sector for both non-incentive and incentive costs. The data used was pulled from EIA-861 form responses. In the range being considered for this study, all sectors showed increasing costs, except the residential incentive costs, which was flat. It was also necessary to adjust the cost curves to account for the savings from LEDs for the different utility's residential portfolios.

As mentioned previously in this section, the primary data used was from utilities in the Southeast sharing similar climate and was restricted to utilities of a similar size. This region was defined as South Carolina, North Carolina, Alabama, Georgia, Maryland, Virginia, Arkansas, Florida, Kentucky, Louisiana, New Jersey, Kansas, Missouri, and Oklahoma. Utility size was roughly restricted to between one quarter and four times the size of the DESC sector sales for either residential or commercial and industrial. Data from some utilities were excluded when identified as outliers, likely from errors in the data. The full list of utilities included from the region and used as data sources are listed below.

- Dominion Energy South Carolina, Inc
- Duke Energy Carolinas, LLC
- Duke Energy Progress - (NC)
- Alabama Power Co
- Georgia Power Co
- Jackson Electric Member Corp - (GA)
- Sawnee Electric Membership Corporation
- Baltimore Gas & Electric Co
- Delmarva Power
- Southern Maryland Elec Coop Inc
- The Potomac Edison Company
- Entergy Mississippi LLC
- Mississippi Power Co
- Duke Energy Carolinas, LLC
- Duke Energy Progress - (NC)
- Appalachian Power Co
- Virginia Electric & Power Co
- Entergy Arkansas LLC
- Clay Electric Cooperative, Inc
- Duke Energy Florida, LLC
- Florida Power & Light Co
- Gulf Power Co
- JEA
- Lee County Electric Coop, Inc
- Orlando Utilities Comm
- Sumter Electric Coop, Inc
- Tampa Electric Co
- Withlacoochee River Elec Coop
- Kentucky Power Co
- Kentucky Utilities Co
- Louisville Gas & Electric Co
- Entergy Louisiana LLC
- Entergy New Orleans, LLC
- Southwestern Electric Power Co
- Atlantic City Electric Co
- Jersey Central Power & Lt Co
- Public Service Elec & Gas Co
- Evergy Metro, KS
- Evergy Metro, MO
- Evergy Missouri West
- Union Electric Co - (MO)
- Oklahoma Gas & Electric Co
- Public Service Co of Oklahoma

In addition to the primary data, secondary data was used for the program expansion estimates. This data was compiled by ICF for previous studies and included the rest of the Eastern and Midwest states. This data was not given the same weight in the analysis and was used when expanding portfolio and programs beyond the range commonly seen in the Southeast.

2.4.4.2 Program Costs

ICF estimated program costs to reflect average annual costs over the study period; incentive and non-incentive program cost estimates were developed. Incentives are program payments to customers, contractors, retailers, or manufacturers that lower the cost of efficient products and services. Non-incentive costs include administration, marketing, education and training, and evaluation costs. The primary source for the program costs was current and historical program spending. In developing new programs, ICF program implementation and program design experience and program costs in other territories were considered. Cost estimates by program are presented in the results section.

2.4.4.3 Participation

A participation rate is the percentage of eligible stock or applicable customer population predicted to install an efficiency measure each year.

For all existing programs and measures, historical data fed into the development of the participation levels. These participation rates were also used as proxies for new measures. In the High case scenario, benchmarking data was used to determine the potential expansion of the programs in future years to a new maximum market acceptance rate.

In developing the program expansions, benchmarking data was used. Additional details on the benchmarking process can be found in the previous section. DESC and ICF ensured that any new measure and/or program and related forecasts are supported by evaluated data or heavily supported by program experience in a similar service territory.

Once the potential maximum annual participation rate was determined via the benchmarking analysis, a ramp-up shape was developed based on numerous factors. Factors considered included the program planning cycles, the nature of the measure, and the timeline of the study. This shape was used for both the expansion of existing programs as well as the ramping up of new programs. Because such a wide variety of measures are included in this study, we could not apply just one formulaic approach to estimating program participation for all measures. Each measure was put in a group[7] with similar measures for assigning participation trends.

2.5 Technical and Economic Potential Results

This section provides an overview of the technical and economic potential results. Table 7 summarizes the results based on the cumulative first-year savings for each scenario from 2023 through 2037 and how this compares to 2021 sales. Details on the results at the sector-level are provided as well.

As is noted in the table, the total technical potential savings over the study period represent 40.8% of 2021 sales and about 80% of these savings can be implemented cost-effectively. In the residential sector, technical potential savings are about 35.6% of 2021 sales, and about 85% of these savings are cost-effective. Meanwhile, technical potential savings are about 45.9% of sales in the commercial and industrial (C&I) sectors, with about 77% of these savings being cost-effective.

[7] Most programs have multiple measure groupings, or bundles. Some, such as Home Energy Reports, only have one group.

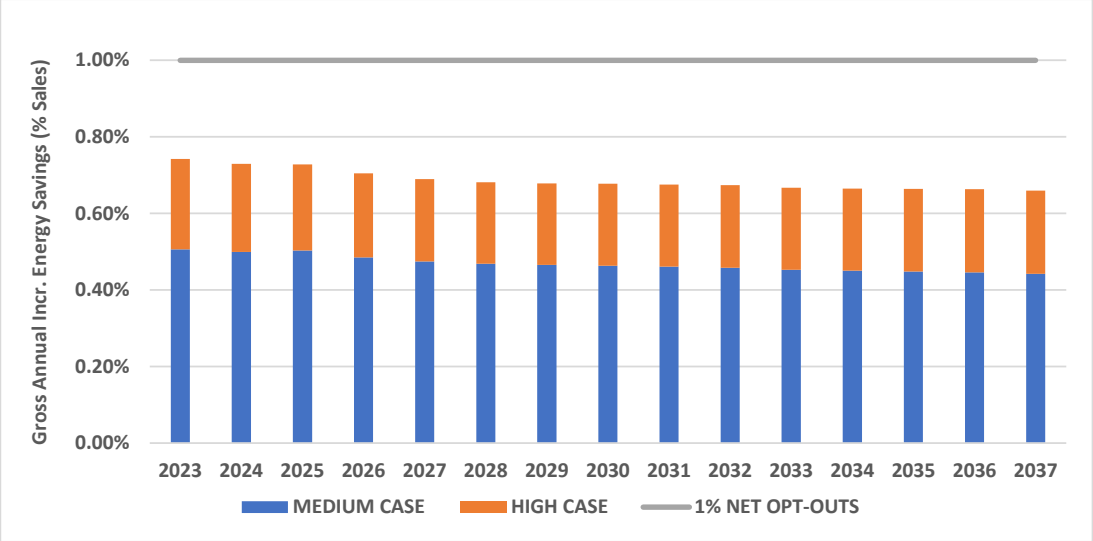
Table 7: Summary of Technical and Economic Potential Results for 2023-2037

Scenario		Residential	C&I	Total
Technical Potential	Savings (GWh)	2,972	3,891	**6,863**
	% 2021 Sales	35.6%	45.9%	**40.8%**
Economic Potential	Savings (GWh)	2,531	2,994	**5,525**
	% 2021 Sales	30.4%	35.3%	**32.9%**

2.6 Achievable Potential Results

This section provides an overview of the achievable potential results for the Medium case, High case, and Low case achievable potential scenarios, including results for energy and demand savings, program costs, and program cost-effectiveness. Results are presented at the program, sector, and portfolio levels. As shown in Figure 2, which provides a comparison of the gross incremental energy savings as a percent of DESC's 2021 sales, the gross annual incremental energy savings are below 1.0% of DESC sales.[8]

Figure 2: Comparison of Gross Incremental Energy Savings and DESC Sales



2.6.1 Overall Portfolio

This section provides an overview of the results at the sector and portfolio levels. Figure 3 and Figure 4 summarize the annual incremental energy and demand savings from each of the scenarios, providing a comparison of the results for 2024, 2030, and 2037. Figure 3 also provides insights into the energy savings as a proportion of DESC's overall 2021 sales. The figure shows that energy savings are relatively evenly split between the residential and commercial and industrial (C&I) portfolios of programs in 2024. However, the exhibits show that the residential programs make up a larger portion of the overall savings later in the study period.

[8] Figures presented in the rest of the report represent Net savings, while Gross savings information is provided in the files in the Appendices. In addition, the benchmark against DESC's 2021 sales excludes opt-out customers.

Figure 3: Annual Incremental Energy Savings (GWh) for Achievable Potential Scenarios by Sector

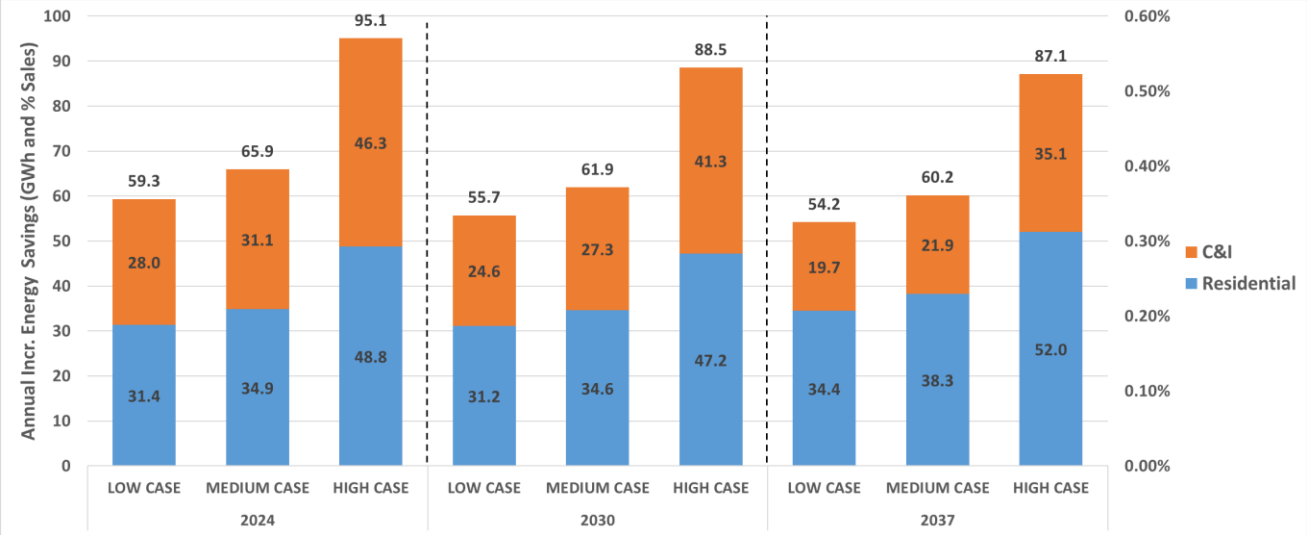


Figure 4: Annual Incremental Demand Savings (MW) for Achievable Potential Scenarios by Sector

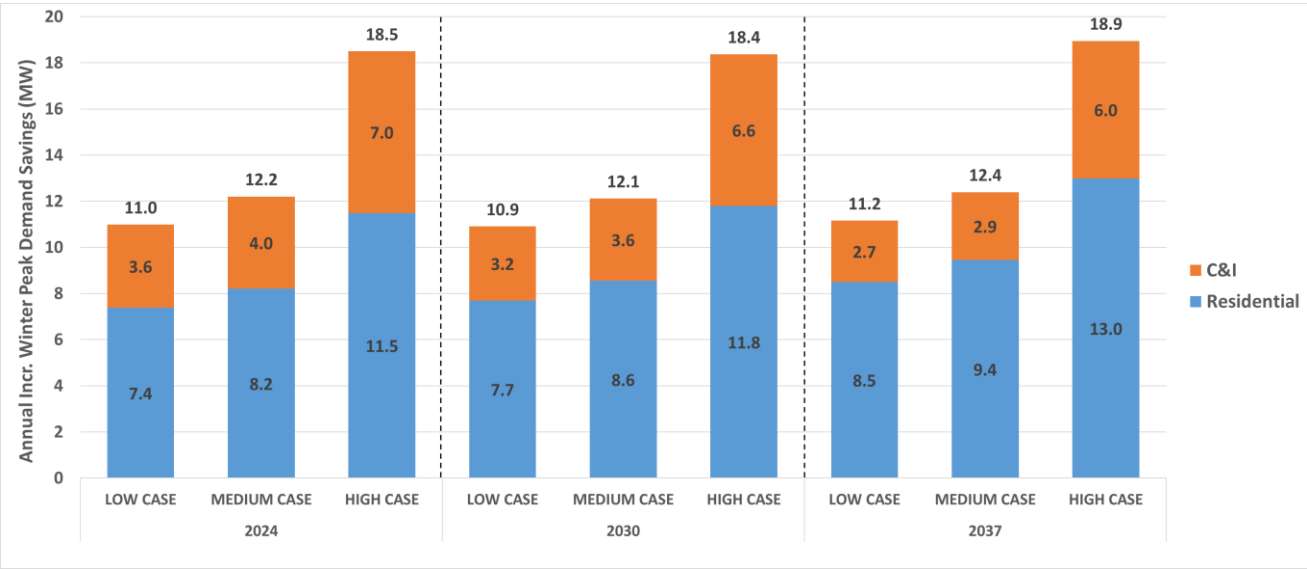


Figure 5 summarizes the annual incremental program costs by sector for each of the achievable potential scenarios. The figure provides a comparison of the program costs at three milestones, showing that program costs for the Medium case range from $13.8M to $14.7M for the residential portfolio, while they range from $6.4M to $10.4M for the commercial and industrial portfolio.

Figure 5: Annual Program Costs ($Millions) by Sector

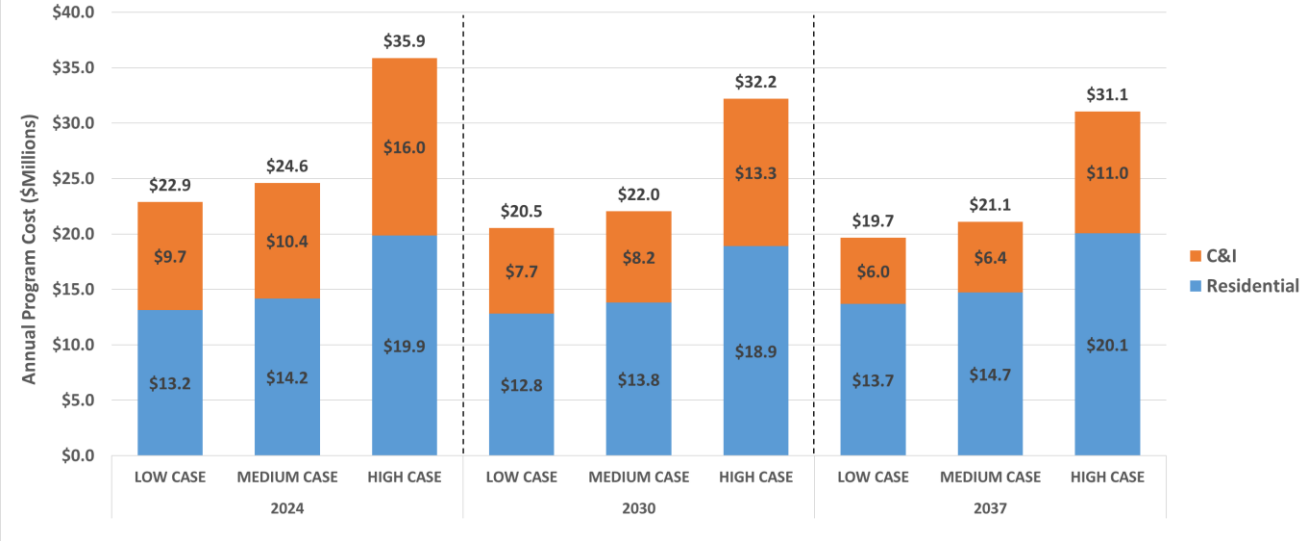


Table 8 summarizes the results of the cost-effectiveness analysis by sector for each of the scenarios. The table also summarizes the overall portfolio-level results, showing that the cost-effectiveness of the Low and High cases is slightly lower than the Medium case.

Table 8: Cost-Effectiveness by Sector

Sector	Medium	Low	High
Residential	1.2	1.2	1.1
C&I	1.4	1.3	1.2
Total	1.3	1.2	1.1

The following sections provide additional insights into the residential and C&I results, including findings on energy and demand savings, program costs, and cost-effectiveness at the program level.

2.6.2 Residential Programs

This section provides an overview of the residential sector results at the program level. Figure 6 and Figure 7 summarize the annual incremental energy and demand savings from each of the scenarios, providing a comparison of the results for 2024, 2030, and 2037. As shown in the figures, the Home Energy Report program accounts for over 50% of energy savings but a small portion of winter peak demand savings.

Figure 6: Annual Incremental Energy Savings (GWh) by Residential Program

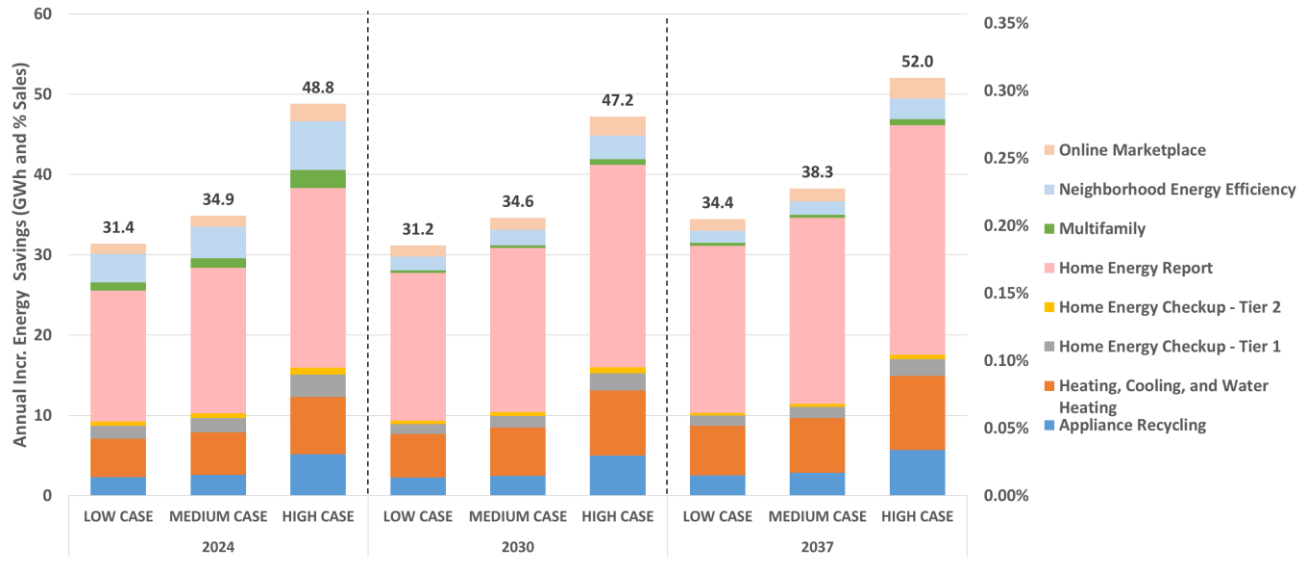
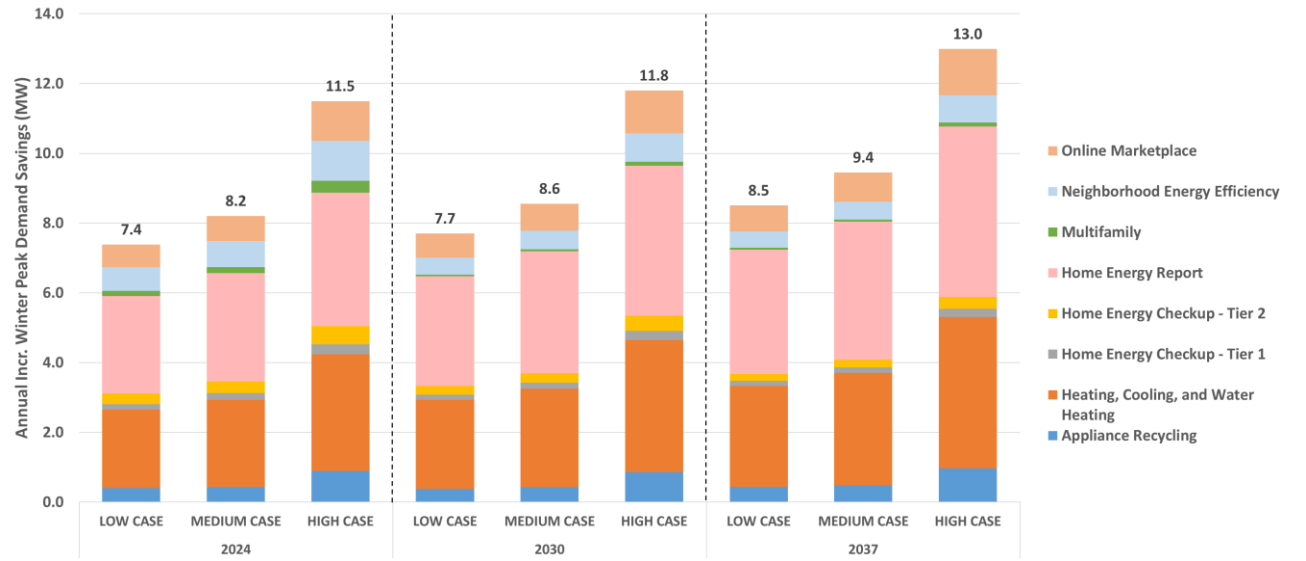
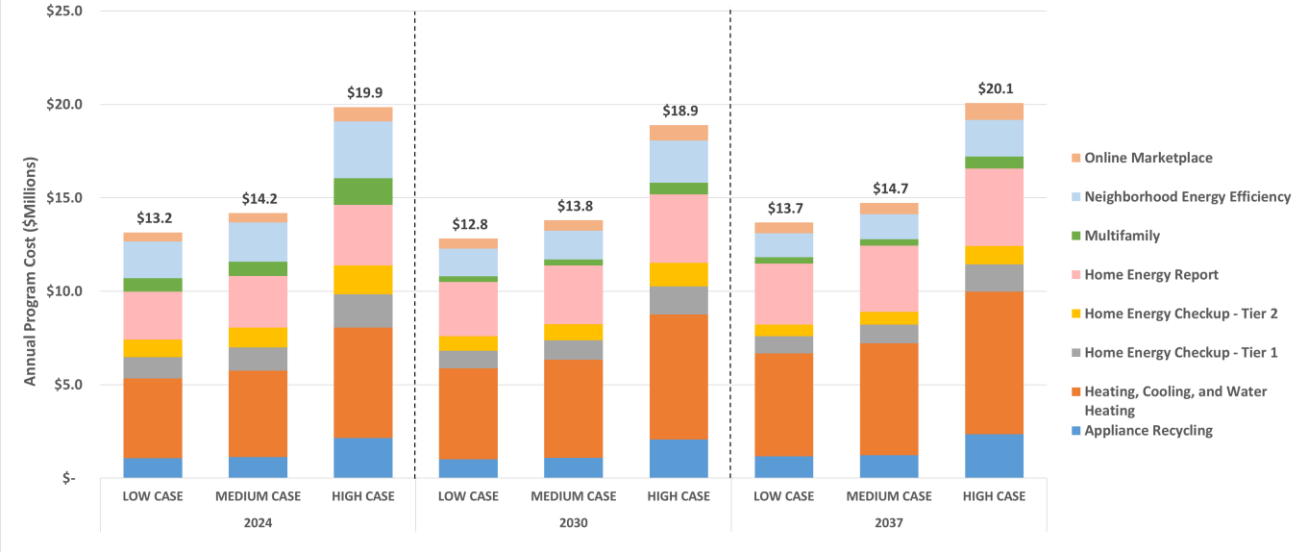


Figure 7: Annual Incremental Demand Savings (MW) by Residential Program



The annual incremental program costs for the residential portfolio range from $13.8M to $14.7M in the Medium case scenario, with the Heating, Cooling, and Water Heating program accounting for the largest share of program spending and the Home Energy Report program accounting for the second-largest portion of program spending. Overall costs are about 35-40% higher in the High case and about 7% lower in the Low case.

Figure 8: Annual Residential Program Costs by Program



As shown in Table 9, the TRC for the entire residential sector portfolio of programs is 1.2 in the Medium and Low cases and all of the individual programs are cost-effective, except for Home Energy Checkup – Tier 2. However, this program is integrated into the broader Home Energy Checkup program, which is cost-effective overall. The cost-effectiveness is slightly lower in the High case, reflecting higher program costs per unit savings for this scenario.

Table 9: Residential Program Cost-Effectiveness (TRC)

Program	Medium	Low	High
Appliance Recycling	1.0	1.0	1.0
Heating, Cooling, and Water Heating	1.2	1.2	1.1
Home Energy Checkup - Tier 1	1.7	1.7	1.6
Home Energy Checkup - Tier 2	0.5	0.5	0.5
Home Energy Report	1.2	1.1	1.1
Multifamily	1.6	1.5	1.5
Neighborhood Energy Efficiency	1.1	1.0	1.0
Online Marketplace	2.5	2.4	2.3
Total (Residential Portfolio)	1.2	1.2	1.1

2.6.3 C&I Programs

This section provides an overview of the C&I sector results at the program level. Figure 9 and Figure 10 summarize the annual incremental energy and demand savings from each of the scenarios, providing a comparison of the results for 2024, 2030, and 2037. Savings for the Municipal Lighting program are only shown in the first milestone since it is anticipated that this program will be ramped down by 2025, as the opportunity to replace inefficient streetlighting is addressed. As shown in the figures, the Energy Wise for Your Business program accounts for the majority of the savings. Savings are also shown as decreasing in later years for all scenarios as energy efficiency opportunities such as lighting are realized.

Figure 9: Annual Incremental Energy Savings (GWh) by Commercial Program

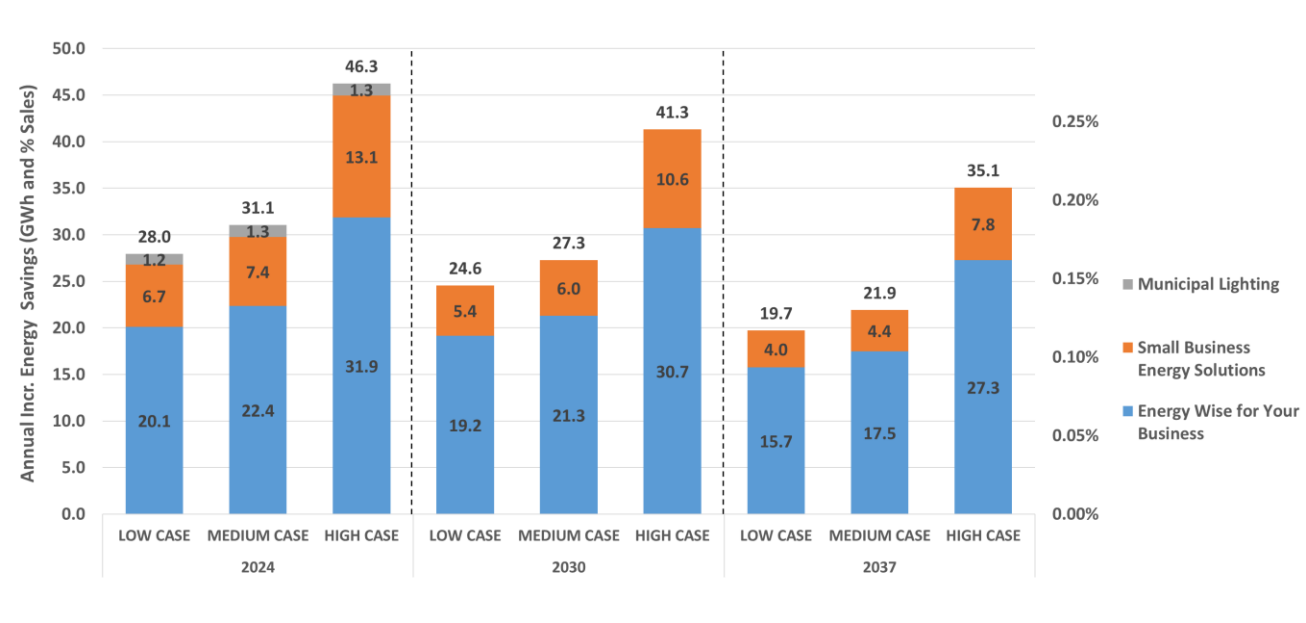
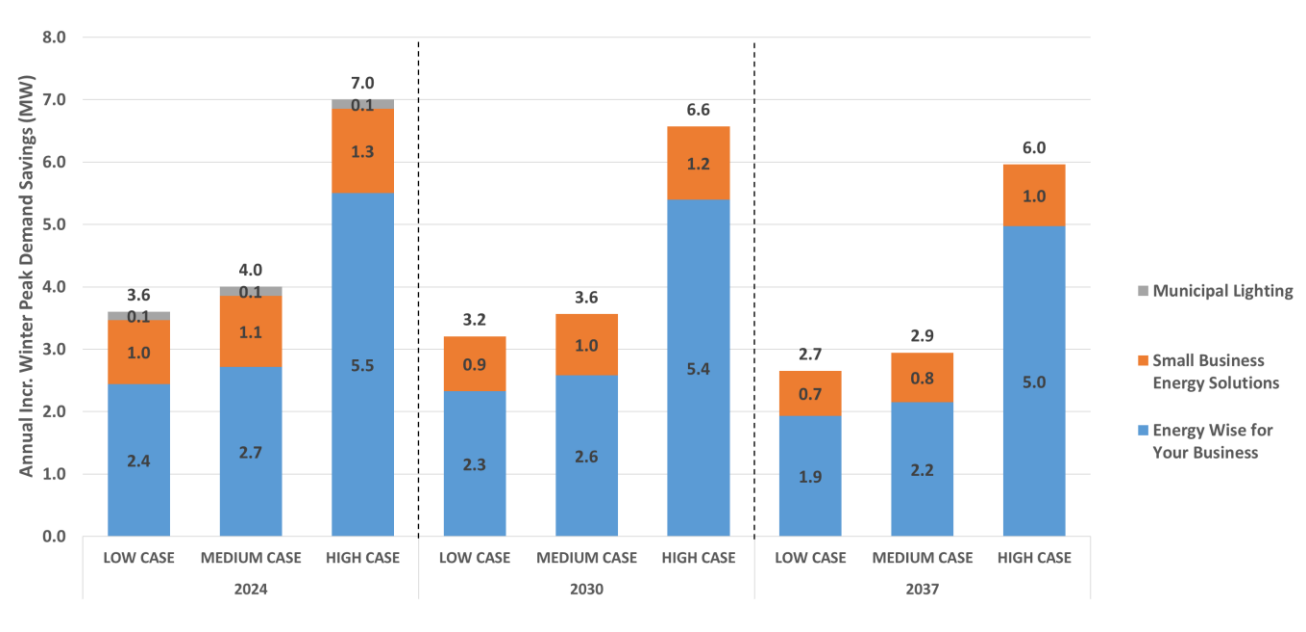
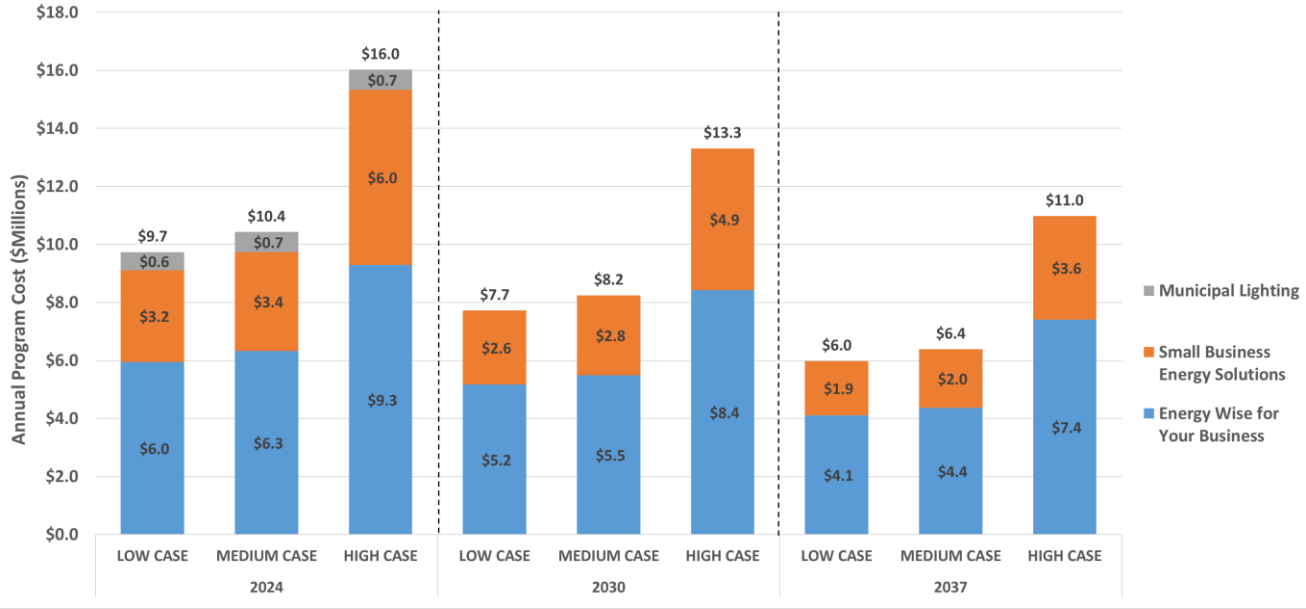


Figure 10: Annual Incremental Demand Savings (MW) by Commercial Program



The annual incremental program costs for the residential portfolio range from $6.4M to $10.4M in the Medium case scenario, with the Energy Wise for Your Business program accounting for the largest share of program spending. Overall costs are about 55-70% higher in the High case and about 6-7% lower in the Low case.

Figure 11: Annual Commercial Program Costs



As shown in Table 10, the TRC for the entire C&I sector portfolio of programs is 1.4 in the Medium case and all the individual programs are cost-effective. The cost-effectiveness is slightly lower in the High and Low cases, reflecting higher program costs per unit savings for these scenarios.

Table 10: C&I Program Cost-Effectiveness (TRC)

Program	Medium	Low	High
Energy Wise for Your Business	1.3	1.3	1.2
Municipal Lighting	1.4	1.4	1.4
Small Business Energy Solutions	1.5	1.4	1.3
Total (C&I Portfolio)	1.4	1.3	1.2

2.7 Commission-Required Forecasts

This section summarizes the results of the commission-required forecasts that represent 1-2% annual incremental savings in 2024 relative to DESC's 2021 sales, excluding opt-out customers. As requested by the Commission, this includes scenarios 0.25% increments between 1-2%. As such, scenarios representing 1%, 1.25%, 1.5%, 1.75%, and 2% incremental annual savings were modeled. All these scenarios represent savings that are beyond the maximum (High) scenario results that are discussed above, meaning that the Commission-required forecasts require participation that is beyond the maximum that can be reasonably achieved through DESC's DSM programs and would need to include measures and/or programs that are not cost-effective. Given this, ICF does not believe these scenarios are achievable, but has taken steps to model these theoretical scenarios.

2.7.1 Overall Results

This section provides an overview of the results at the sector and portfolio levels. Figure 12 and Figure 13 summarize the annual incremental energy and demand savings from each of the scenarios, providing a comparison of the results for 2024, 2030, and 2037. The figures show that savings later in the study period are lower. This is due to the program participation being so high in the early milestones that there are less energy efficiency opportunities in later years.

Figure 12: Annual Incremental Energy Savings (GWh) by Sector

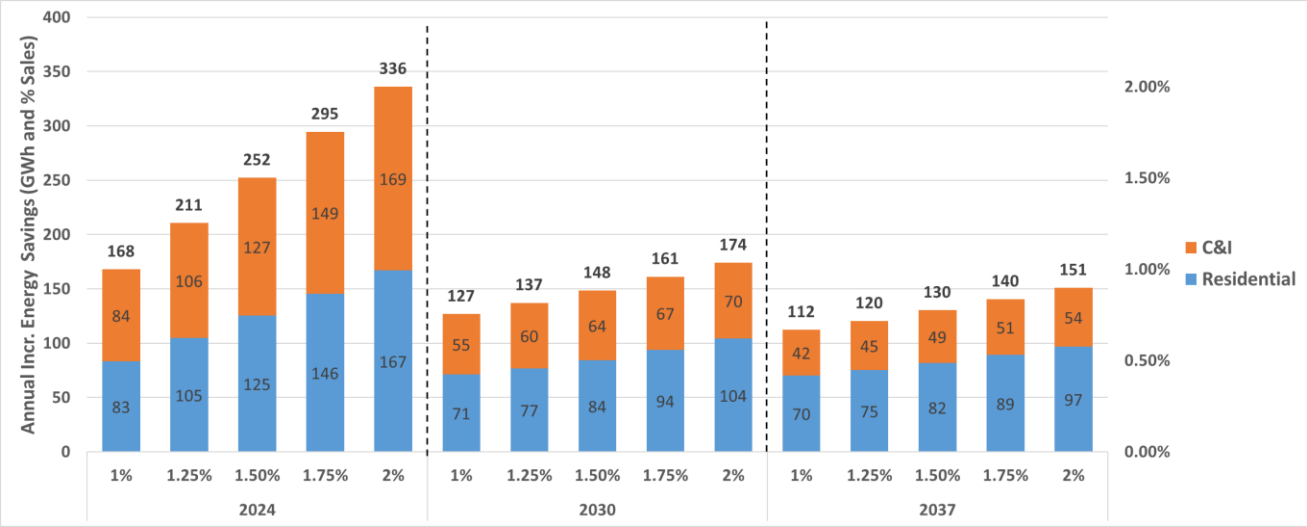


Figure 13: Annual Incremental Demand Savings (MW) by Sector

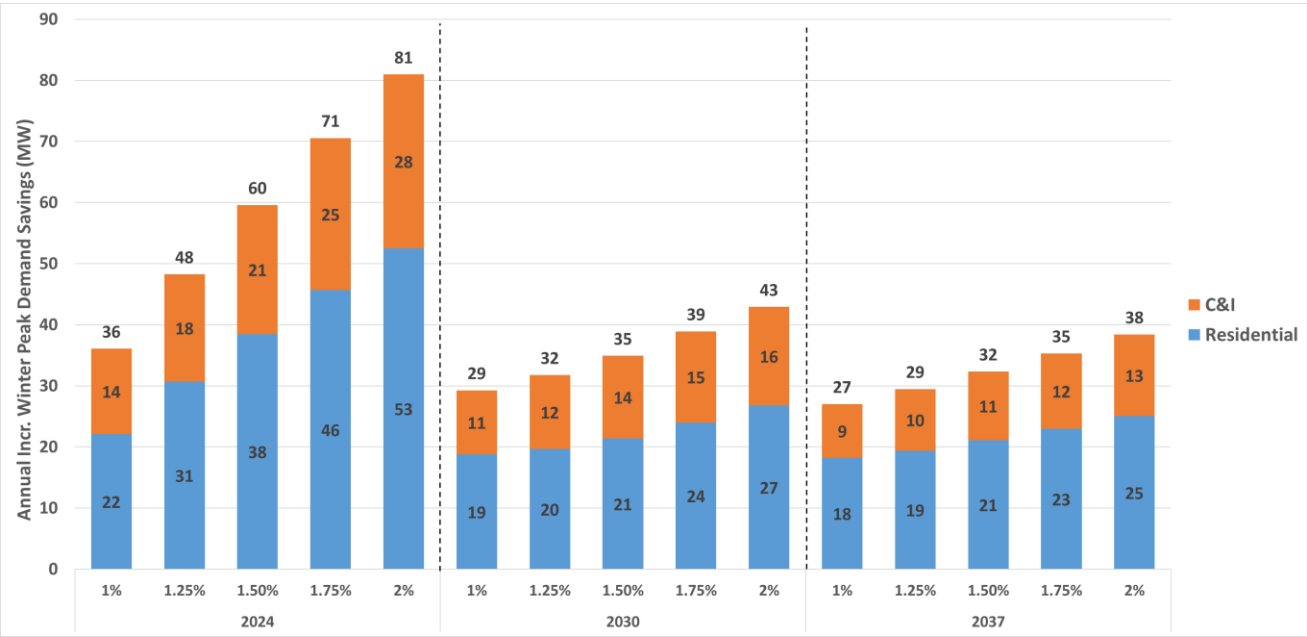


Figure 14 summarizes the annual incremental program costs by sector for each of the scenarios. Similar to the previous figures, program costs in later milestones are lower. The impact on reduced program costs in later milestones is more pronounced for C&I programs.

Figure 14: Annual Program Costs ($Millions) by Sector

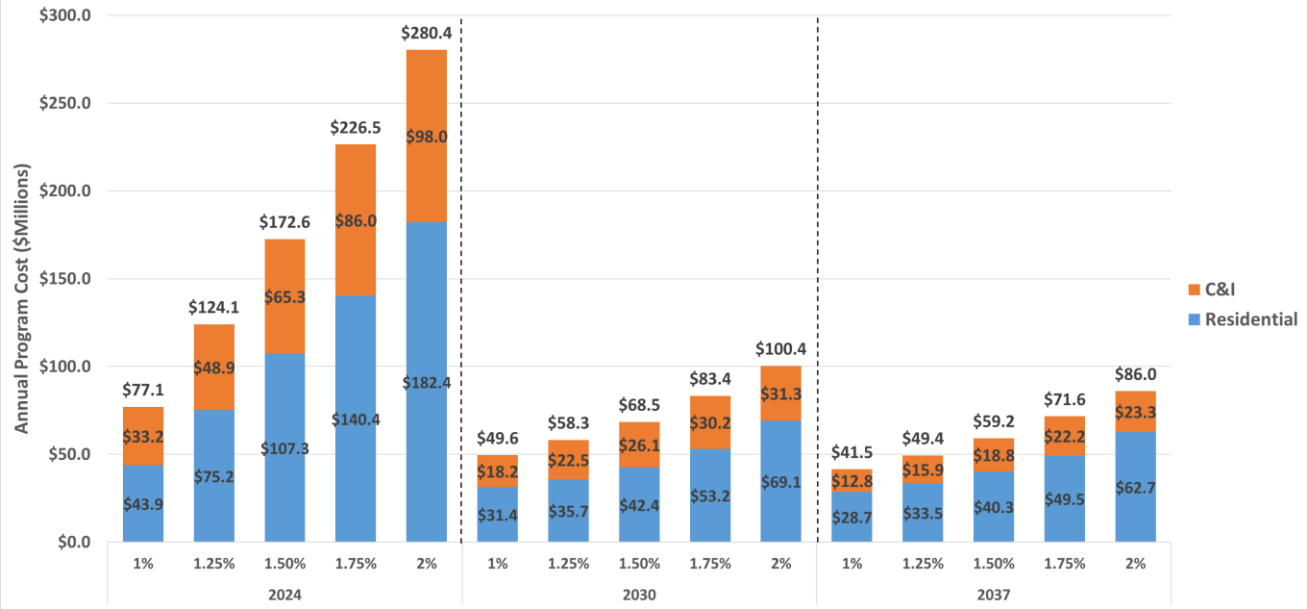


Figure 15 summarizes the results of the cost-effectiveness analysis by sector for each of the scenarios. The table also summarizes the overall portfolio-level results, showing that all of the scenarios are not cost-effective and that the program cost-effectiveness decreases for the scenarios with higher savings.

Figure 15: Cost-Effectiveness by Sector

Sector	1.00%	1.25%	1.50%	1.75%	2.00%
Residential	0.9	0.8	0.8	0.8	0.7
C&I	1.0	0.9	0.9	0.8	0.8
Total	**0.9**	**0.8**	**0.8**	**0.8**	**0.7**

2.7.2 Residential Results

This section provides an overview of the residential sector results at the program level. Figure 16 and Figure 17 summarize the annual incremental energy and demand savings from each of the scenarios, providing a comparison of the results for 2024, 2030, and 2037.

Figure 16: Annual Incremental Energy Savings (GWh) by Residential Program

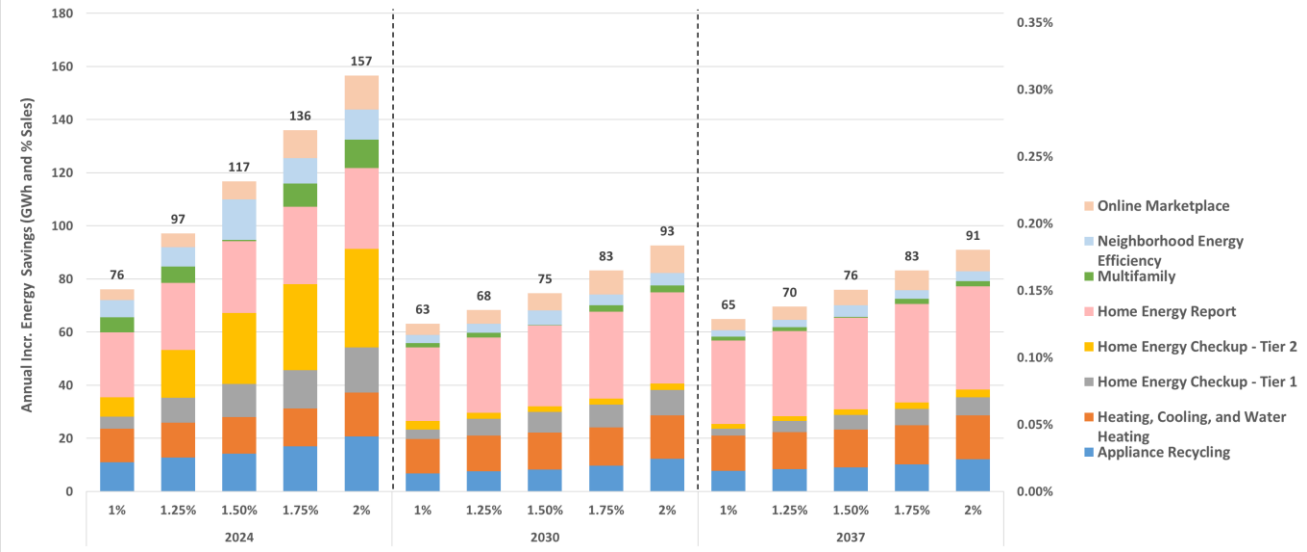


Figure 17: Annual Incremental Demand Savings (MW) by Residential Program

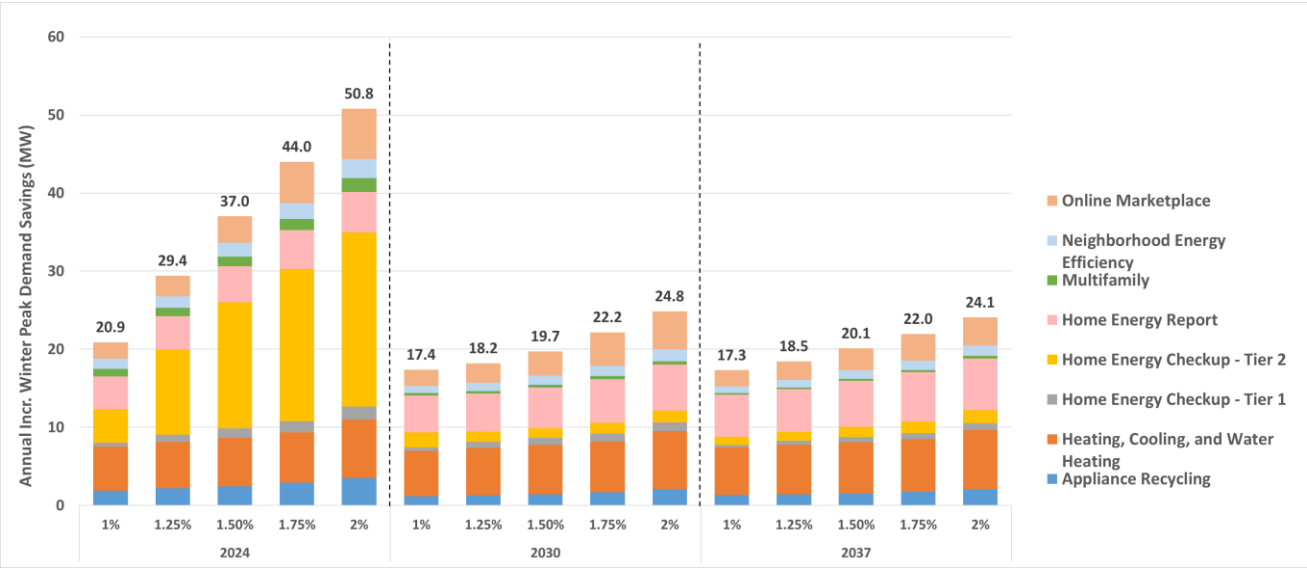


Figure 18 summarizes the program costs for each scenario, showing that overall program costs range from $43.9M to $182.4M in 2024. This compares to an estimated residential portfolio program cost of $14.2M in the Medium case.

Figure 18: Annual Residential Program Costs by Program

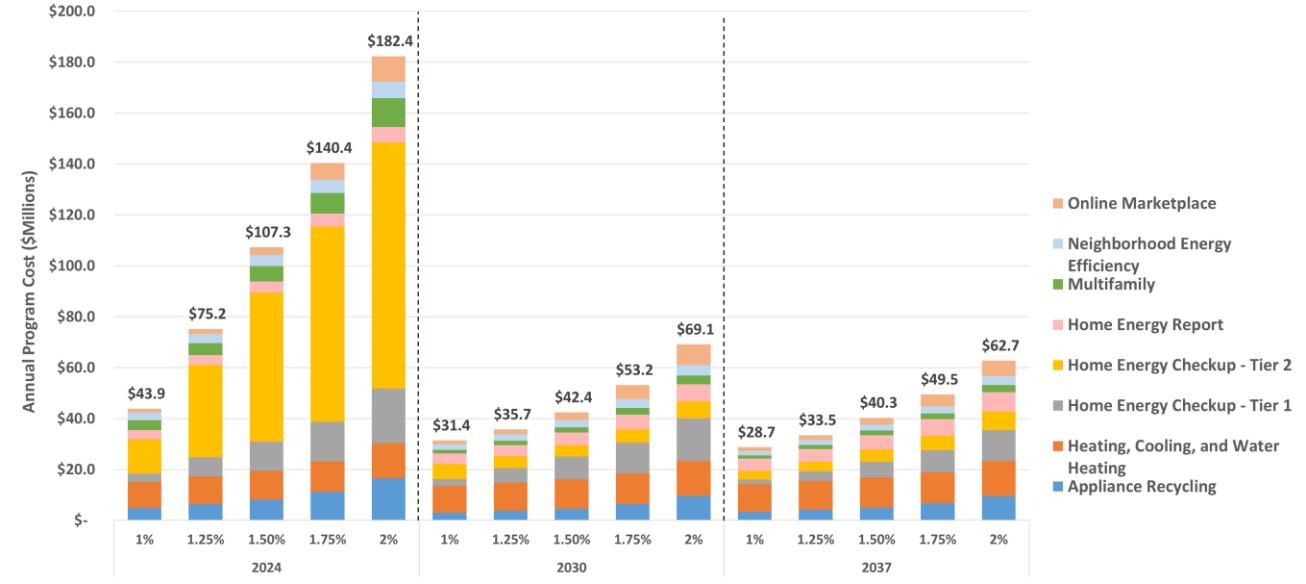


Table 11 summarizes the results of the cost-effectiveness analysis by residential sector program for each of the scenarios and the overall residential program portfolio, showing that all of the scenarios are not cost-effective and that the program cost-effectiveness decreases for the scenarios with higher savings.

Table 11: Residential Program Cost-Effectiveness (TRC)

Program	1.00%	1.25%	1.50%	1.75%	2.00%
Appliance Recycling	1.0	0.9	0.8	0.7	0.6
Heating, Cooling, and Water Heating	0.9	0.9	0.9	0.9	0.9
Home Energy Checkup - Tier 1	1.7	1.2	0.9	0.7	0.5
Home Energy Checkup - Tier 2	0.4	0.4	0.4	0.4	0.4
Home Energy Report	2.6	2.2	1.8	1.5	1.1
Multifamily	1.9	1.6	1.4	1.2	0.9
Neighborhood Energy Efficiency	1.2	1.2	1.1	1.1	1.0
Online Marketplace	2.4	2.2	1.9	1.5	1.2
Total (Residential Portfolio)	**0.9**	**0.8**	**0.8**	**0.8**	**0.7**

2.7.3 C&I Results

This section provides an overview of the residential sector results at the program level. Figure 19 and Figure 20 summarize the annual incremental energy and demand savings from each of the scenarios, providing a comparison of the results for 2024, 2030, and 2037.

Figure 19: Annual Incremental Energy Savings (GWh) by Commercial Program

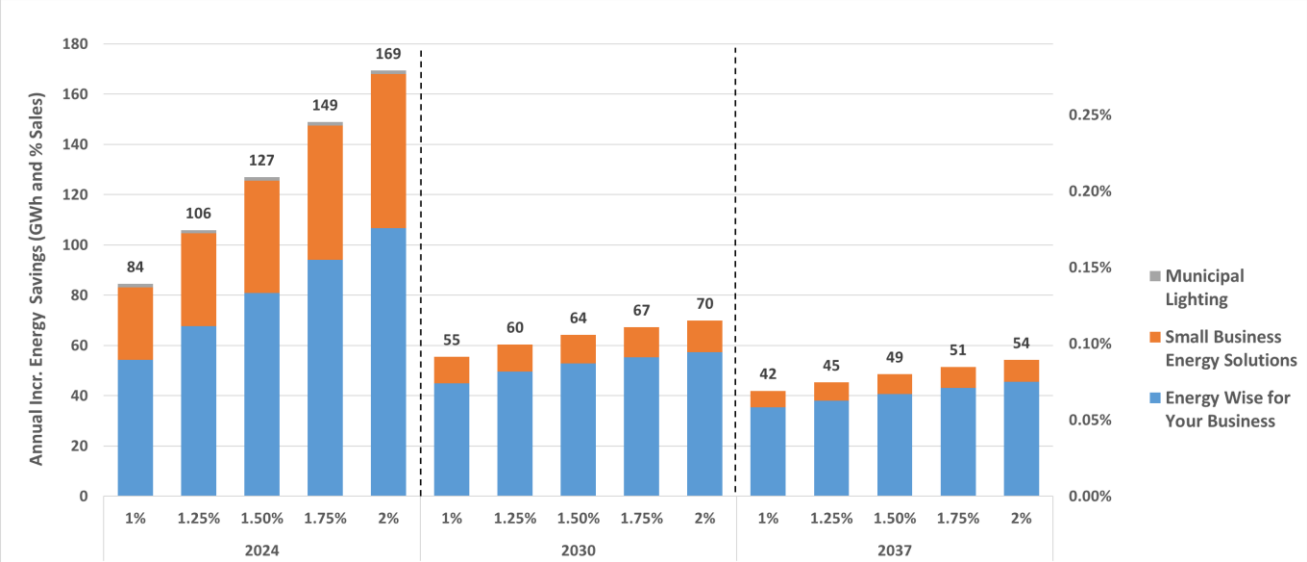


Figure 20: Annual Incremental Demand Savings (MW) by Commercial Program

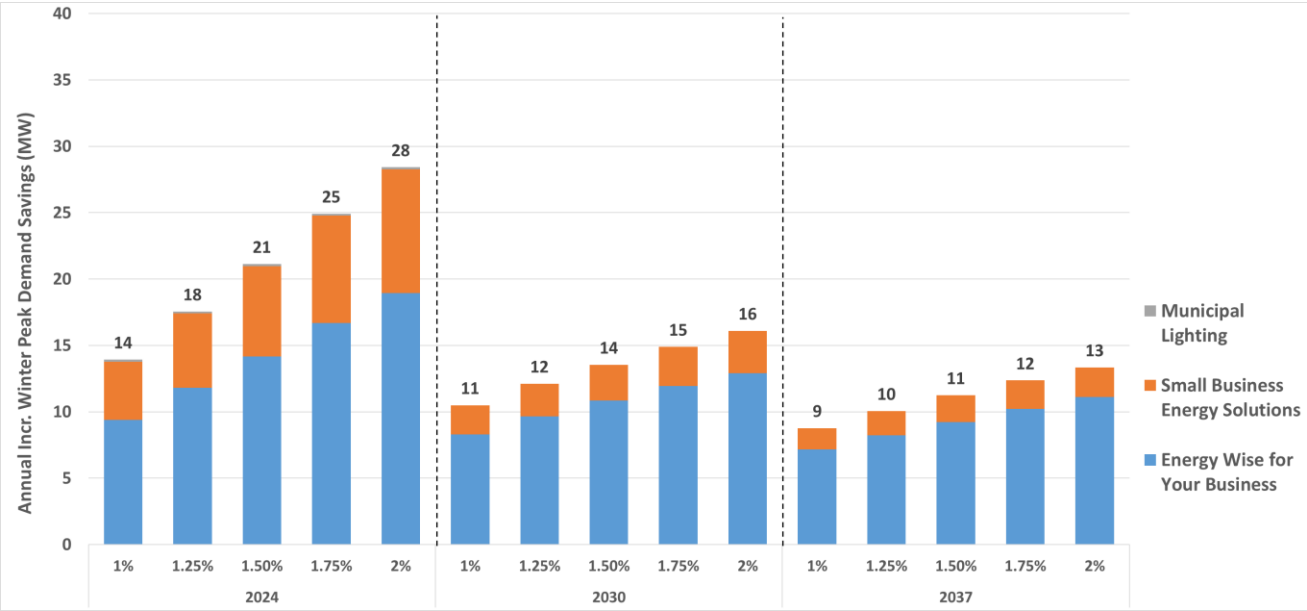


Figure 21 summarizes the program costs for each scenario, showing that overall program costs range from $33.2M to $98.0M in 2024. This compares to an estimated commercial portfolio program cost of $10.4M in the Medium case.

Figure 21: Annual Commercial Program Costs

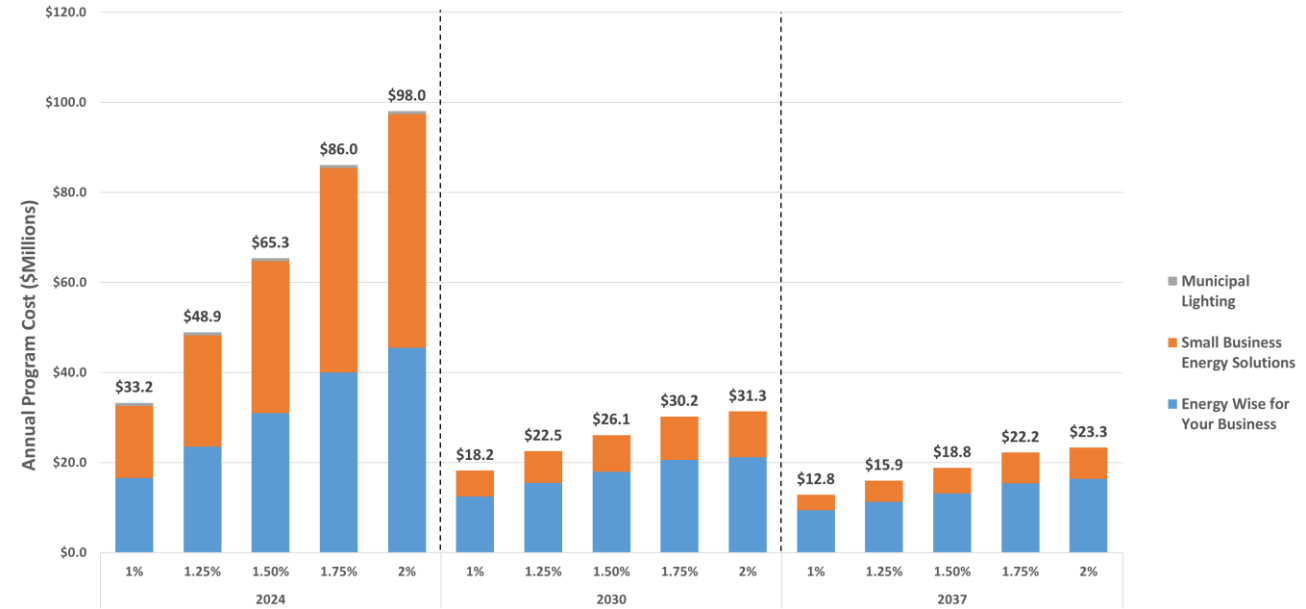


Table 12 summarizes the results of the cost-effectiveness analysis by C&I sector program for each of the scenarios and the overall C&I program portfolio, showing that all of the scenarios are not cost-effective and that the program cost-effectiveness decreases for the scenarios with higher savings.

Table 12: C&I Program Cost-Effectiveness (TRC)

Program	1.00%	1.25%	1.50%	1.75%	2.00%
Energy Wise for Your Business	0.9	0.9	0.9	0.8	0.8
Municipal Lighting	1.4	1.4	1.4	1.4	1.4
Small Business Energy Solutions	1.0	0.9	0.9	0.8	0.8
Total (C&I Portfolio)	**1.0**	**0.9**	**0.9**	**0.8**	**0.8**

2.8 Key Findings

Key findings from the EE potential study are as follows:

- In the Medium case, annual incremental savings in 2024 represent 0.39% of 2021 sales and these savings decrease slightly throughout the study period as the opportunity for energy efficiency is reduced. Savings in the High case are about 44% higher in 2024, representing 0.57% of 2021 sales.

- In terms of Residential sector programs, the Home Energy Report program is the largest savings opportunity, replacing lighting as the most important savings type. The Heating, Cooling, and Water Heating program is the second largest contributor to savings. High case programs could increase residential sector savings by about 40% above the Medium case.

- In terms of Commercial and Industrial (C&I) sector programs, the Energy Wise for Your Business program accounts for the majority of the savings and the Municipal Lighting program only contributes early in the study since it is anticipated that this program will be ramped down by 2025. High case programs could increase C&I sector savings by about 49% above the Medium case.

- The combined portfolio of residential, commercial, and industrial programs has a Total Resource Cost (TRC) ratio of 1.28 in the Medium case, 1.14 in the High case, and 1.24 in the Low case.

- The Commission-required forecasts represent a minimum 77% increase above the High achievable potential case. These forecasts also require participation that is beyond the maximum that can be reasonably achieved through DESC's DSM programs.

The results of the potential study reflect the reality that a 1% reduction in sales is not achievable. As a result, any discussion of savings past the High case is theoretical and would have to include non-cost effective measures and participation values that are not achievable.

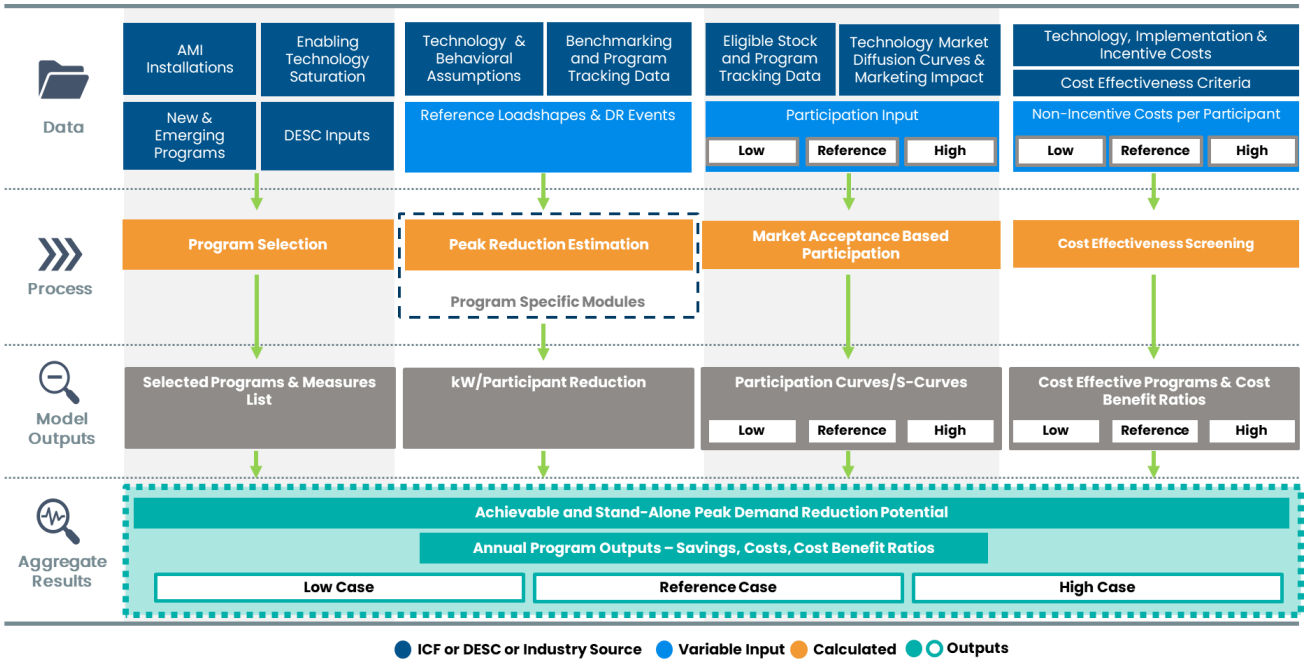
3 DEMAND RESPONSE (DR) POTENTIAL

ICF completed a comprehensive evaluation of demand response programs for both residential and commercial customers with an emphasis on decreasing the winter peak. The analysis was presented by sector in bundles where the forecast included opt-in as compared to opt-out enrollment. DESC notes that while the analysis was comprehensive, industry best practices may counsel toward more selectivity in program implementation.

3.1 Overview

A high-level process flow of ICF's bottom-up approach for DR potential evaluation, which includes calculation of program participation, savings impacts, and costs for various DR programs, is shown in Figure 22. The process began with data collection, which fed into the process steps of the potential evaluation: program selection, participation modeling, peak reduction estimation, and cost-effectiveness screening. The outputs at each stage of the process were inputs to the DERPlanner model, and the end result is the program potential from the cost-effective programs. Details of each of the process steps are discussed in Section 3.4.3.

Figure 22: Summary of ICF's Approach to DR Achievable Potential Modeling



The analysis began with the development of a comprehensive list of DR program types currently implemented in U.S. markets. The data required to model and evaluate the parameters for different programs were then collected, such as implementation costs, market size, and participation criteria. Data sources include DESC data from the ODC study; publicly available data, such as potential studies and annual reports; and ICF expert input. This information was then run through the ICF demand response models to produce the desired outputs (i.e., the potential DESC winter peak impact due to existing and expanded DR programs, along with the details of savings forecasted for every year of the analysis, annual program costs, and program benefit-cost results).

Three primary achievable scenarios were analyzed for the study: (1) the **Reference** case that assumes expected reasonable levels of participation, with maximum market shares coming from the ODC study; (2) the **Low** case that sets participation estimates to a conservative estimate to provide a lower bound on the achievable potential when all cost-effective programs are implemented; and (3) the **High** case that

assumes aggressive marketing and implementation strategies to achieve higher participation levels. Further variations and additional scenarios to better inform the potential are outlined in Section 3.4.2.

3.2 DR Program Types and Definitions

3.2.1 Program Types Modeled

The potential estimation process began by assessing the options of DR programs, that are classified into three types – dispatchable, hybrid and rate-based programs.

- **Dispatchable programs** are programs in which the utility offers customers payments for installing demand-response enabled devices and reducing demand during specified periods when an event is called. The reduction is usually done by a direct control of switches by the utility or through a signal to the DR-enabled devices.
- **Hybrid programs** are programs that usually are associated with a tariff rider and rely on the price or incentive-based response of the customers, but the response is expected only during the DR events that are called by the utility.
- **Rate-based programs** are programs in which customers voluntarily reduce their demand in response to energy price signals or pre-informed pricing structures in which they enrol ("opt-in" programs). In this study, all the programs were modeled as opt-in, except for the time of use ("ToU") program which was modelled as both opt-in and opt-out.

Table 13. List of DR Programs Modeled

Program Type	Residential	Commercial and Industrial
Rates	Time of Use (Opt-in and Opt-out)	Time of Use (Opt-in and Opt-out)
	Demand Rates	Real Time Pricing
Hybrid	Peak Time Rebate	Interruptible
	Critical Peak Pricing	Critical Peak Pricing
Dispatchable	Backup Generation	Standby Generation (Backup Generation)
	Smart Thermostat	Smart Thermostat
	DLC - Water End-Uses	DLC - Water End-Uses
	DLC - Battery Storage	Auto Demand Response
	DLC - EV Smart Charger	

Twelve different programs - which included the existing interruptible load, backup generation programs as well as time of use and demand rates - were selected to model for this analysis, as shown in Table 13. These were the result of the following criteria that were used to choose the programs most applicable to the DESC service area:

- DESC hourly load profile
- Availability of required technologies for program deployment
- Availability of data from programs across the United States
- Discussion with DESC
- Expert opinion of ICF

For the standby generator program, EPA changes (NESHAP RICE[9]) which limit non-compliant units from running more than 500 hours/year, has restricted and limited participation. Hence, throughout the course of ICF's analysis, the capacity provided by the standby generator program was assumed to remain constant at 25 MW from wholesale and 10 MW from retail based on historical data. The interruptible program, on the other hand, also garners little additional participation in the low and reference cases (in the order of 14 MWs to add to the existing 174 MWs), since a large percentage of industrial customers that would most likely participate in the offerings have either already enrolled or made the decision to opt-out of the current DSM programs. This is due to the fact that winter curtailments present greater challenges to manufacturing and other industrial customers since one important consideration includes needing to heat facilities and buildings during the coldest times of the year. The high case forecasts an aggressive scenario wherein the restrictions on participations are usually assumed to be minimal, and hence the higher values even for Interruptible program.

Note that the achievable potential results only show the potential for the programs, among the ones listed above, that clear the TRC benefit-cost ratio greater than 1. The screening results and the programs that clear those tests are shown in Section 3.5.

3.2.2 Program Definitions

Definitions for new programs are outlined in this sub-section.

- **Critical Peak Pricing:** CPP is an event-based program, where-in a tariff rider defines the pricing structure for the CPP program, wherein the price is set to a high value during peak events and a lower than 'flat-price' is offered during the specified off-peak hours. Applicable to residential and C&I sectors.
- **Peak Time Rebate:** Peak Time Rebates is also an event-based program that provides incentives to customers based on reduction of usage (in kWh) during peak events. The incentives are paid as per the reduction measured based on a baseline non-event usage. Applicable to residential sector.
- **Smart Thermostat:** A program in which the program administrator can remotely control connected smart thermostats on event days to change the thermostat setpoint during peak period. The program was modeled with three different modes of delivery – bring-your-own-thermostat, do-it-yourself and direct install. Applicable to residential and small commercial sectors
- **Water Heater:** A program in which the administrator can remotely control connected water heaters through DLC or smart switches on event days to either cycle or switch off the water heater during peak period. Smart switches for water heaters also have to optimize the heating patterns, similar to smart thermostats for cooling, using learning algorithms. Applicable to residential and C&I sectors.
- **Battery Storage:** Battery Storage program is modeled as an event-based program, where in the battery is charged during the off-peak hours and is set to provide power to the customer during the events. The frequency of events called for this program is usually higher than in other DR programs. Applicable to residential sector.
- **EV Smart Charger:** Electric Vehicle (EV) smart chargers is a program that manages charging of EVs during demand response events. The peak load is curtailed by reducing the speed of charging through the smart chargers or telemetry. Applicable to residential sector.
- **Real Time Pricing:** Real Time Pricing is rate-based program in which the retail price change on an hourly basis and the customer is usually notified a day ahead of the 24-hour prices. Applicable to C&I sector.
- **Auto-Demand Response:** Auto Demand Response is an event-based program where demand is curtailed via pre-programmed mechanisms within the building energy management system. For these programs, the building energy management system is connected to the DERMS, and the signal automatically triggers the pre-programmed action.

[9] National Emission Standard for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines

3.3 Data Collection

3.3.1 Utility System Data

Utility system data provided by DESC is listed here:

- Forecasted hourly load for 2023-2037, by customer class
- Forecasted annual system energy and demand forecasts, by customer class and season
- Forecasted electricity avoided capacity and energy costs for 2023-2037
- Forecasted customer counts, by sector
- AMI meter saturation data
- Utility discount rate
- Reserve margin and transmission and distribution losses as a percentage
- Retail rates of electricity, by sector

3.3.2 Measure and Program Data

Based on the data provided, territory-specific inputs were developed for the selected programs. Existing program data were obtained from DESC documents such as program tracking reports and tariff documents. For example, Interruptible load and standby generation programs data were obtained as follows:

- Incentive levels from rate documents or paid incentives details
- Program historic MW levels

New and modified program data and modeling are discussed in more detail in the following tables and sub-sections.

Peak Reduction

While the tariff-based programs used a percentage of participant peak as the peak reduction estimate, most other programs that are technology controlled use a kW per participant reduction.

Table 14: Peak Reduction Inputs for Demand Response Modeling

Sector	Program - Measure	Unit	Winter Peak Savings
Residential	**Time of Use**	kW per participant	0.32
Residential	**Demand Rate**	kW per participant	0.2
Residential	**Critical Peak Pricing**	kW per participant	0.57
Residential	**Peak Time Rebate**	kW per participant	0.22
Residential	**Smart Thermostat**	kW per participant	0.92
Residential	**Water Heater**	kW per participant	0.45
Residential	**Battery Storage**	kW per participant	2.43
Residential	**EV Smart Charger**	kW per participant	0.92
Commercial	**Time of Use**	kW per participant	0.41
Commercial	**Real Time Pricing**	kW per participant	0.59

Sector	Program - Measure	Unit	Winter Peak Savings
Commercial	**Critical Peak Pricing**	kW per participant	0.59
Commercial	**Interruptible Load**	Percent of participant peak	58%
Commercial	**Smart Thermostat**	kW per participant	0.92
Commercial	**Water Heater**	kW per participant	0.9
Commercial	**Backup Generators**	NA	Existing*
Commercial	**Auto Demand Response**	Percent of participant peak	11%
Industrial	**Time of Use**	Percent of participant peak	1.90%
Industrial	**Real Time Pricing**	Percent of participant peak	2.70%
Industrial	**Critical Peak Pricing**	Percent of participant peak	2.70%
Industrial	**Interruptible Load**	Percent of participant peak	40%
Industrial	**Auto Demand Response**	Percent of participant peak	11%

Participation

The maximum market shares used in the Bass Diffusion curves, as described in Section 3.4.3, are shown in Table 15. The low case is usually about 0.75 times the reference case maximum market share, while the high case is about 1.5 times the value in the reference case.

Table 15: Participation Inputs - Maximum Market Share for Bass Diffusion Curve for Demand Response Modeling

Sector	Program - Measure	Maximum Market Share		
		Low	Reference	High
Residential	**Time of Use**	15%	19%	29%
Residential	**Demand Rate**	8%	10%	16%
Residential	**Critical Peak Pricing**	7%	10%	14%
Residential	**Peak Time Rebate**	15%	20%	30%
Residential	**Smart Thermostats**	15%	21%	31%
Residential	**Water Heater**	15%	20%	30%
Residential	**Battery Storage**	1.50%	2%	3%
Residential	**EV Smart Charger**	11%	14%	21%
Commercial	**Time of Use***	10%	14%	21%
Commercial	**Real Time Pricing**	7%	9%	14%
Commercial	**Critical Peak Pricing**	14%	19%	29%
Commercial	**Interruptible Load***	4%	4%	6%

Sector	Program - Measure	Maximum Market Share		
		Low	Reference	High
Commercial	**Smart Thermostat**	3%	4%	6%
Commercial	**Water Heater**	4%	5%	8%
Commercial	**Backup Generators****	100%	100%	100%
Commercial	**Auto Demand Response**	0.10%	0.13%	0.20%
Industrial	**Time of Use***	11%	14%	21%
Industrial	**Real Time Pricing**	7%	9%	14%
Industrial	**Critical Peak Pricing**	14%	19%	29%
Industrial	**Interruptible Load***	45%	45%	55%
Industrial	**Auto Demand Response**	10%	13%	20%

Rates

The existing Time of Use and Demand Rates for DESC were used for potential evaluation.

Table 16: Demand Response Modeling - Rate Inputs

Time of Use Rates

Sector	Residential	Commercial	Industrial
Peak ($/kWh)	$0.24	$0.16	$0.05
Off-Peak ($/kWh)	$0.09	$0.09	$0.04
Demand Rate ($/kW)	$ -	$ -	$12.86
Peak to Off-Peak Ratio	2.67	1.78	1.29
Off-Peak Discount	22%	18%	7%

Demand Rates

Sector	Residential
Peak ($/kWh)	$0.08
Off-Peak ($/kWh)	$0.07
Demand Rate ($/kW)	$7.70
Peak to Off-Peak Ratio	1.13
Off-Peak Discount	38%

DESC Rate 5, 16, and 24 are used for Time of Use for Residential, Commercial, and Industrial sectors respectively. DESC Rate 7 is used for Residential demand rates.

Additional assumptions, such as incentive levels, technical feasibility are provided in the Appendices.

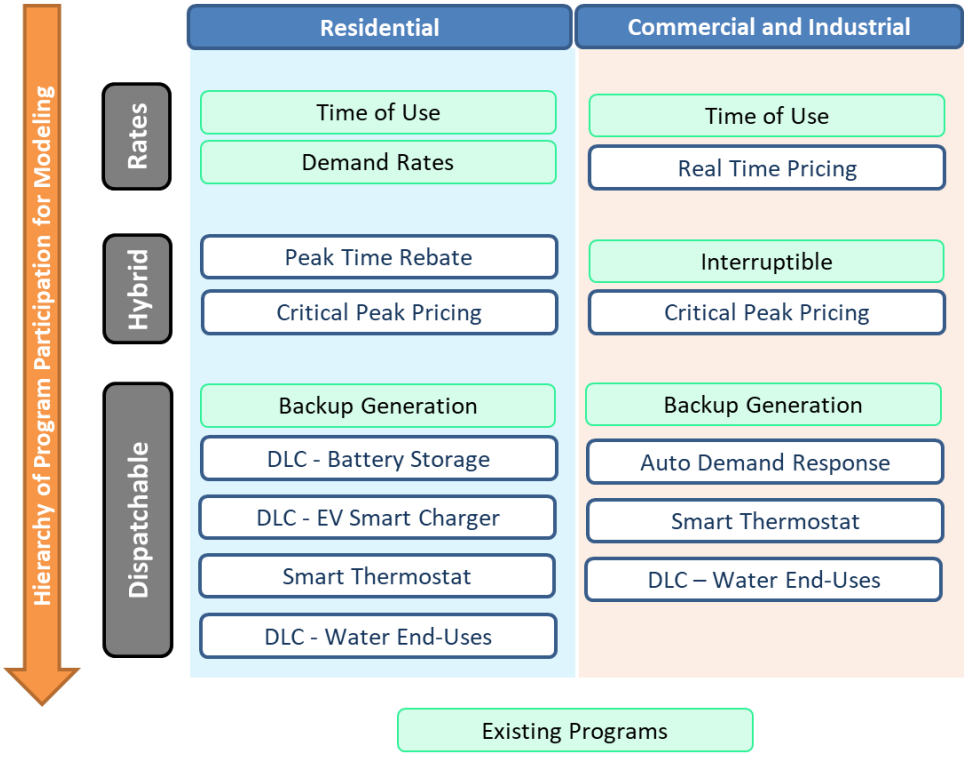
3.4 Program Modeling

3.4.1 Elements of Analysis

The assumptions with respect to the elements of the analysis and the reporting methodology that were made in the study are listed in this section:

- **Peak and peak demand**: The potential study reports demand savings potential for winter peaks. The winter peak period is defined as hours between 6 AM to 9 AM from December through February. The average load of top 15 events with during this period is considered as the peak demand for the demand response measures.
- **Baseline peak**: Using the winter peak events defined within the months of December through February, between 6 AM to 9 AM, the baseline peak load was determined.
- **Economic screening**: All programs were screened for cost-effectiveness with a primary cost-effectiveness test of the TRC test. Programs were included in the achievable potential if it passed the TRC test.
- **Mode of program delivery**: It was assumed that all programs, except for Time of Use (ToU), were opt-in. Time of Use was modeled with both opt-in and opt-out modes of delivery. Note that changing ToU mode of delivery impacts the potential savings from all other programs as well, and hence the results are presented separately for these two cases.
- **Level of savings used in the analysis**: Savings reported for DR are all at the generator (i.e., the savings include transmission and distribution losses). Benefits for cost-effectiveness tests are based on product of energy savings and the avoided costs in Appendix H, after adding in the reserve margin for capacity savings.
- **Program applicability to sub-sectors:**
    - For the residential programs, all programs were assumed to be applicable to all sub-sectors and building types.
    - For the commercial programs, the smart thermostat applies to small and medium commercial customers. DLC–water end uses programs are assumed to be applicable to all sub-sectors and building types within the commercial sector. The interruptible program was applicable to large commercial customers that meet the tariff eligibility criteria.
    - For the industrial sector, the interruptible program applies to all industrial customers that haven't opted out of the DSM programs.
- **Non-Incentive Costs for Programs**: Non-incentive costs for programs that apply to multiple sectors are assumed to have a split of costs between the sectors. For example, the DLC–water end uses program is assumed to be primarily residential, which takes up the bulk of the setup costs, and the commercial programs are assumed to leverage the setup, while incurring a small amount of additional costs, for program administration and implementation.
- **Levelized Cost ($/kW)**: The Levelized cost is the net present value of the cost of unit demand reduction over its lifetime. The costs include all the incentive and non-incentive costs from the UCT test.
- **Program hierarchy**: The program hierarchy was assumed for eligible stock accounting, wherein if a customer can't participate in two programs simultaneously (such as interruptible and smart thermostat), the eligible stock for the second program in the hierarchy assumes that the participants in the first program are excluded.

Figure 23: Demand Response Program Hierarchy Assumption



Note: Only the programs that cleared the TRC test in the high case are included in the study

3.4.2 Scenario Definition and Development

ICF modeled achievable potential under three scenarios. All three achievable scenarios represent *cost-effective, reasonable and achievable* levels of DSM, as directed by the Commission:[10]

- **Reference:** Reasonable and expected levels of participation (maximum market shares from ODC study, where applicable)
- **Low:** Conservative estimates of participation
- **High:** Aggressive marketing and implementation strategies – higher levels of participation. Usually – maximum market share set to 1.5 times the reference levels
- **Stand-Alone Maximum Achievable** by program: No interactive effects with other programs, achievable high case participation levels

3.4.3 Potential Assessment Approach

This potential study involved a four-step process: program selection, peak reduction estimation by program, application of market acceptance-based participation, and then cost-effectiveness screening to result in the achievable potential (Figure 24).

[10] Docket No 2019-226-E – Order No. 2021-429

Figure 24: Potential Assessment Process Flow

- **Program Selection**
  Program selection is a critical task in determining the potential of demand-side management (DSM) resources. There are a myriad of demand response pilots and implementations underway in the United States, but it is important to determine which ones are applicable to the service territory of DESC taking into consideration the eligible technological stock, the load profile characteristics, feasibility of implementation of programs as well as utility and/or stakeholder preference for programs. The programs selected for this study, after discussion with DESC, are listed in Table 13.

- **Peak Reduction Estimation**
  ICF used a bottom-up approach to estimate the demand savings from DR programs and their measures, as applicable. The savings of measures were then aggregated into programs, and the program savings rolled up into the complete DR portfolio savings.

  For the event-based programs modeled in this study, ICF used a direct load control module, a high-level schematic of which is shown in Figure 25.

Figure 25: ICF Direct Load Control Module

For the tariff/rate-based programs, ICF used the Time of Use Rate Evaluation Tool (ToURET) module, a high-level schematic of which is shown in Figure 26.

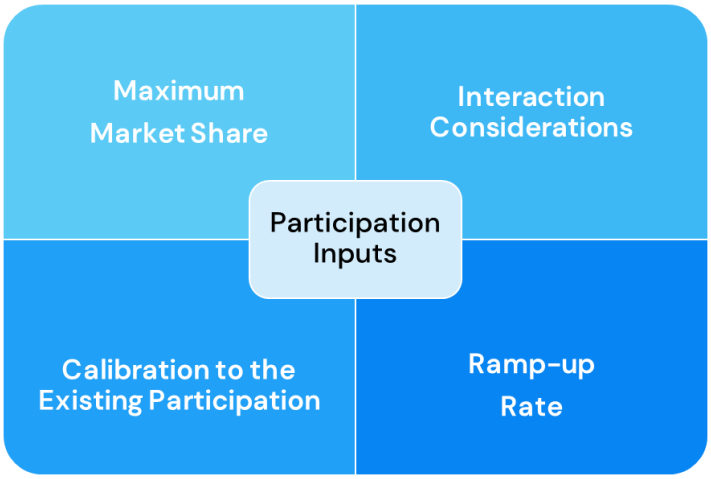
Figure 26: ICF Time of Use Rate Evaluate Tool (ToURET) Module

- **Market Acceptance Based Participation**
  The approach for participation modeling is shown in Figure 27.

Figure 27: Program Participation Process Flow

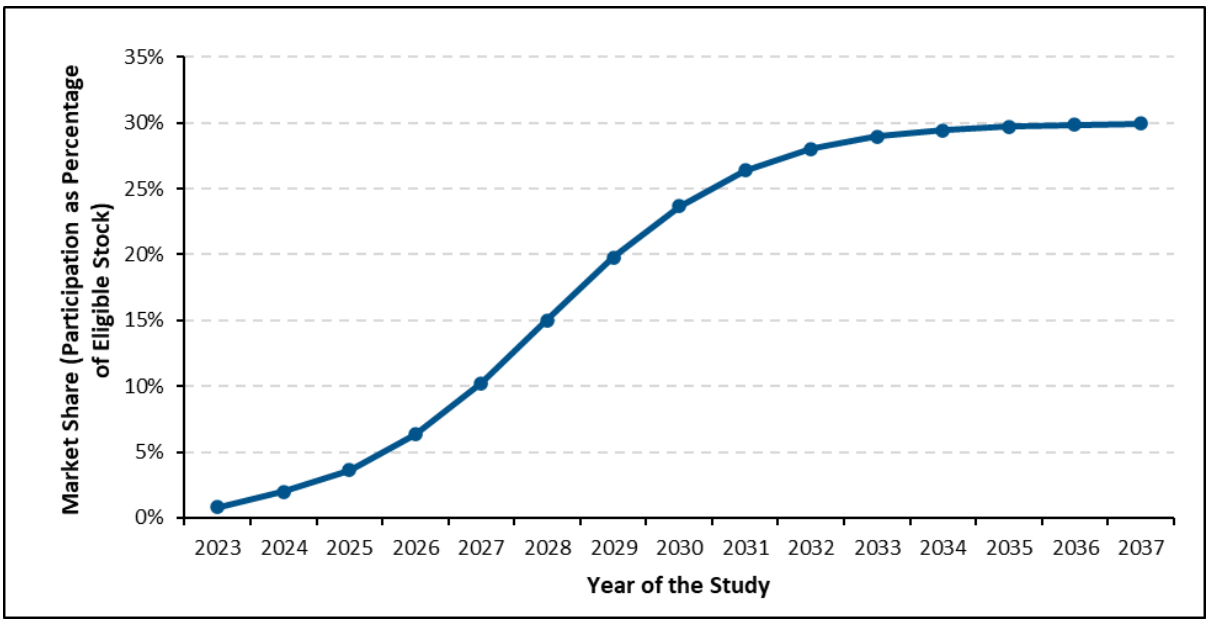
It begins with preparing the inputs (shown in Figure 28) for participation (i.e., estimating eligible stock, maximum market share, ramp-up rates for programs and interaction considerations). These inputs are researched and benchmarked against similar programs from other territories and customized to DESC based on ODC survey data as well.

Figure 28: Participation Inputs



Once all the inputs are gathered, the next step is to build Bass diffusion curves, industry standard curves for estimating adoption of new technologies and implementations. An example of such a curve is shown in Figure 29. The curves are then calibrated to tracking data for existing programs, and then fed into the achievable potential modeling framework.

Figure 29: A Sample Bass Diffusion Curve for Participation Estimation



- **Cost-Effectiveness Screening**
  ICF estimated the implementation and technology costs classified into incentive and non-incentive costs. The overarching assumption was 1 full-time equivalent employee each for the administrative component of the costs and program development, with additional marketing, implementation, and incentive costs layered in. To come up with these costs, ICF leveraged the database of costs it has built over time from various program implementations and resources such as filings and potential studies for new programs. The costs for programs that are common to the residential and

commercial sectors are assumed to be split with the residential program starting up first and taking the bulk of the information technology infrastructure setup. The benefits, on the other hand, were estimated using the avoided capacity and energy costs provided by DESC.

Once the programs were modeled and the corresponding costs determined, the following cost-effectiveness ratios were also estimated for the study - TRC, UCT, Ratepayer Impact Measure (RIM), and Levelized costs ($/kW). The benefits and costs were evaluated over the study period of 15 years.

3.5 Pre-achievable Cost-effectiveness Screening

The study involved two iterations: 1) pre-achievable, to screen for cost-effective programs, and 2) achievable, to estimate potential. The pre-achievable analysis screened programs using high case TRCs (15-year). Programs that have a TRC benefit-cost ratio > 1 in the high case were included in the achievable potential, as shown in the table below.

Table 17. Pre-achievable Cost-effectiveness Screening Results

Sectors	Program	TRC High Case Benefit-Cost Ratio	
		ToU Opt In	ToU Opt Out
Res, Comm, Ind	Critical Peak Pricing	✓	✓
Res, Comm	Smart Thermostat	✓	✓
Comm, Ind	Interruptible Load	✓	✓
Comm, Ind	Real Time Pricing	✓	x
Res, Comm, Ind	Time of Use	✓	✓
Comm	Backup Generators	✓	✓
Res, Comm,	Direct Load Control	x	x
Res	Demand Rate	✓	x
Comm, Ind	Auto Demand Response	x	x
Res	Battery Storage	x	x
Res	EV Smart Charger	x	x
Res	Peak Time Rebate	✓	✓

3.6 Achievable Potential Results

The achievable potential results shown in this section are the DR dispatched annually – calculated as the average reduction from the events in the winter peak periods. The results only include the programs that cleared the cost-effectiveness screening (i.e., TRC >1, along with the existing programs). All the results where opt-in or opt-out mode of ToU program is not explicitly specified refers to the scenarios where ToU is delivered in the opt-in mode. The results for scenario with opt-out ToU are in a separate sub-section.

3.6.1 Overall Portfolio Results

In the reference case, DR programs have the potential to reduce load at the time of the forecasted winter peak demand by 10% by the year 2037, which amounts to 486 MW. Figure 30 shows the trend of savings across the study period for the three scenarios, along with a line for current program savings.

Figure 30: Savings Across the Study Period, by Scenario

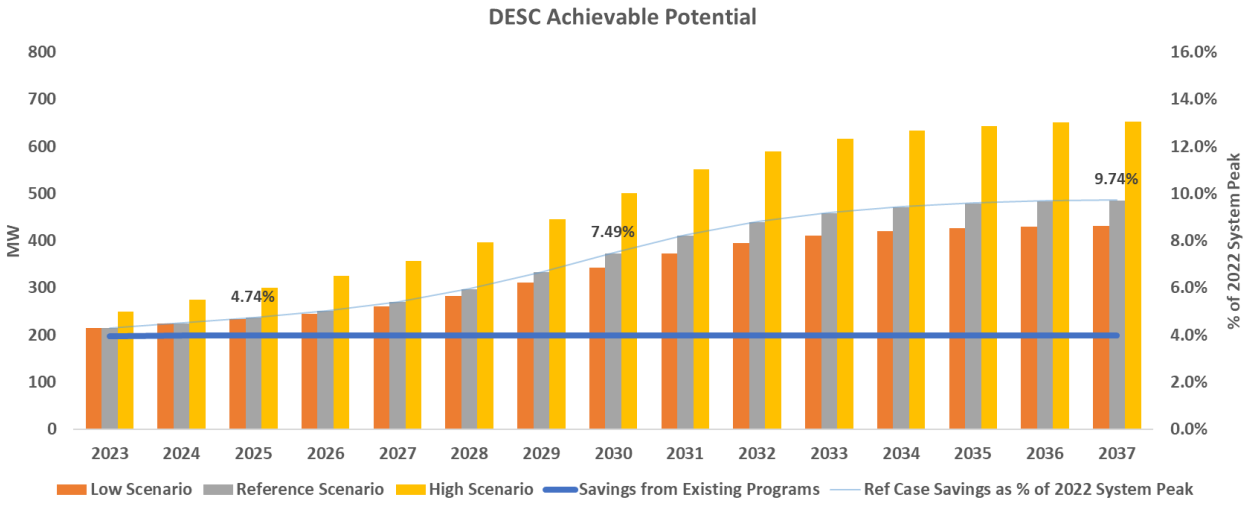


Figure 31 shows the percentage savings of peak demand of each sector, by scenario, that can be reduced from the DR programs. There is almost equal contribution from the residential and C&I sectors towards the end of the study period, as residential programs ramp up.

Figure 31: Percentage Winter MW Peak Savings Split by Sector & Scenario for 2037

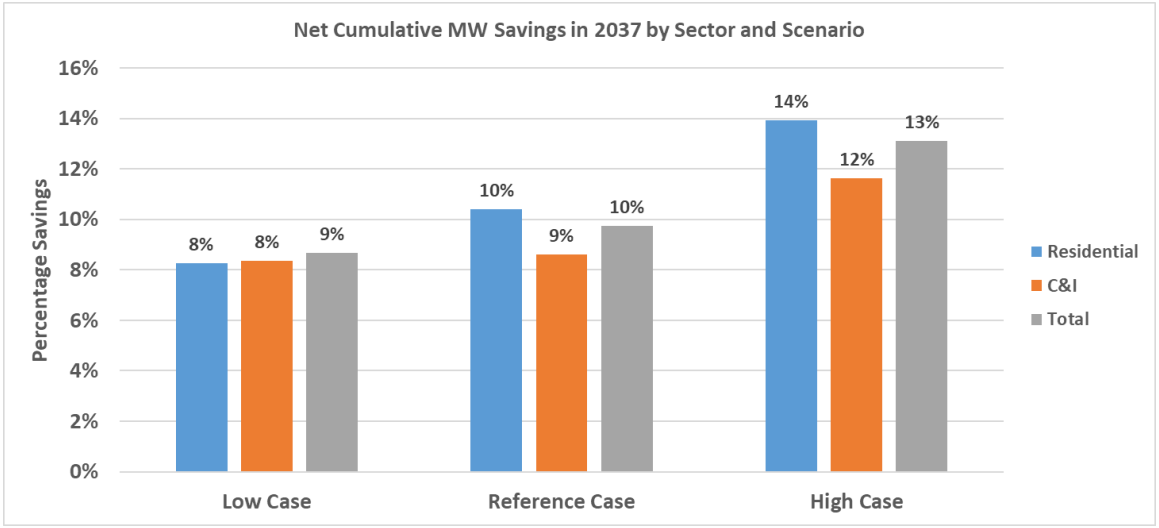


Figure 32 shows the baseline split of the peak load for 2037. The residential sector contributes to 47% of the peak load, while the C&I sector contributes 53%. The savings pie chart in Figure 32 shows the contribution of demand savings, in 2037, from each sector. The savings numbers align with the peak contribution, with C&I contributing slightly higher share of savings than the residential, towards the end of the study period (i.e., 2037).

Figure 32: Baseline and Savings Split by Sector & Scenario for 2037

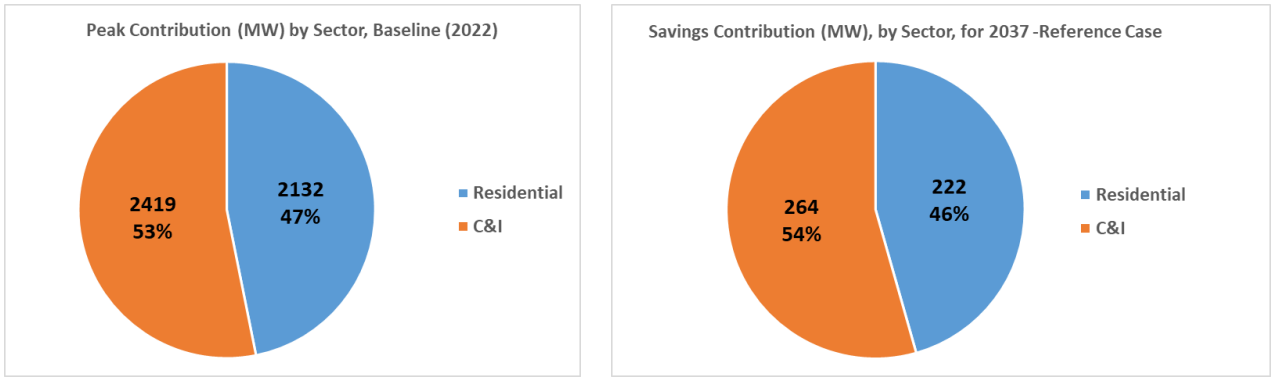
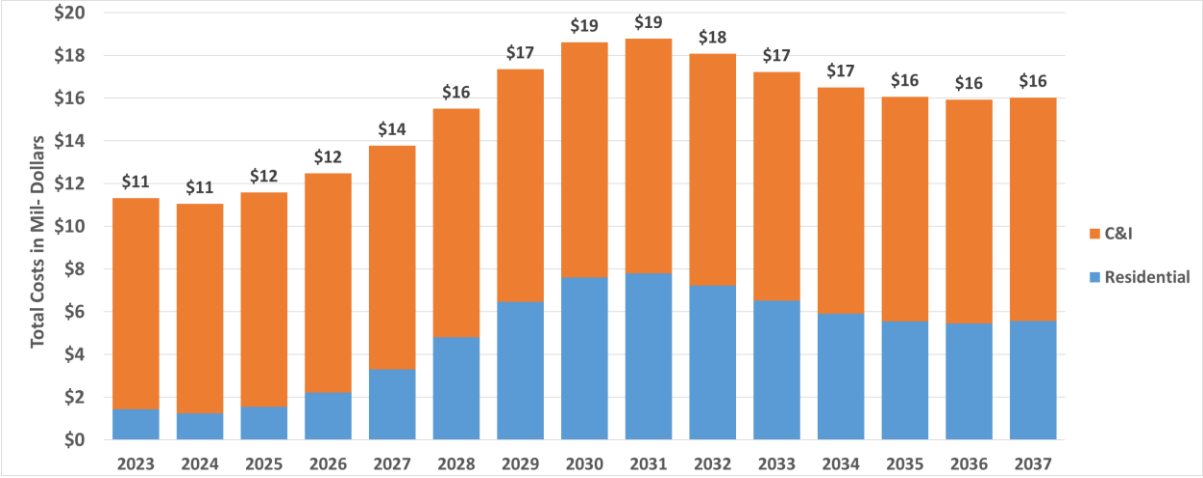


Figure 33 shows the real costs that will be incurred for running the programs in the reference scenario in each year. The real costs are expected to rise until 2031 and then drop till 2035 around when the participation rates for all program participation starts to saturate. The replacement costs of enabling devices, re-participation costs (including marketing) for existing customers whose enabling devices expire and incentives for the larger participant base results in the curve for the second half being at a higher level due to.

Figure 33: Annual Program Costs Split by Sector for Achievable Reference Scenario

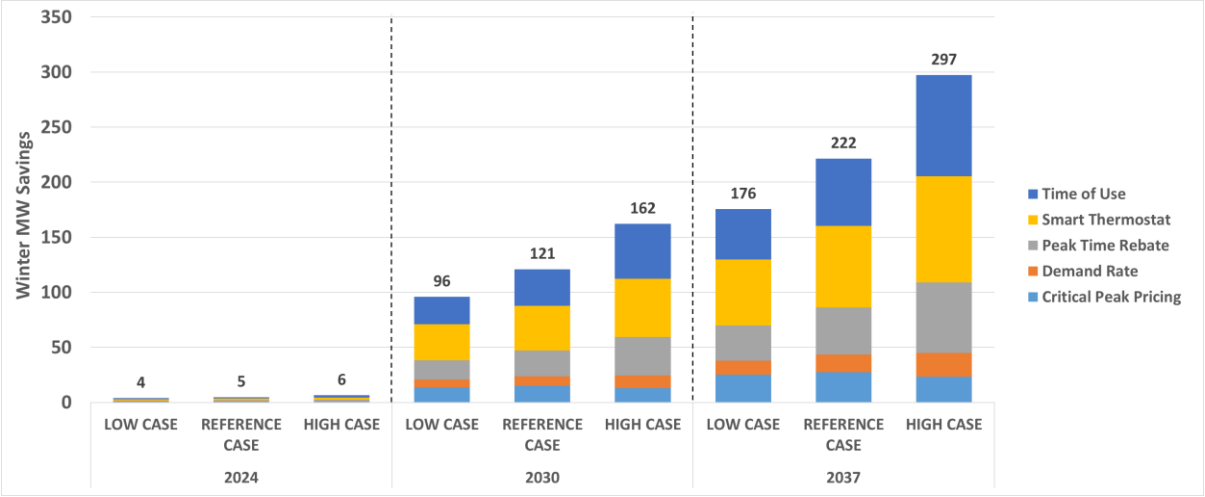


3.6.2 Residential Results

Demand Savings

Figure 34 shows the residential savings potential for select years, by program, for Low, Reference and High cases for select years. Savings are estimated to reach 222 MW in reference case and 297 MW in the high case by 2037. In 2037, smart thermostats and time of use programs contribute to the bulk of the savings at 34% and 28% of the total residential savings, respectively, for reference case.

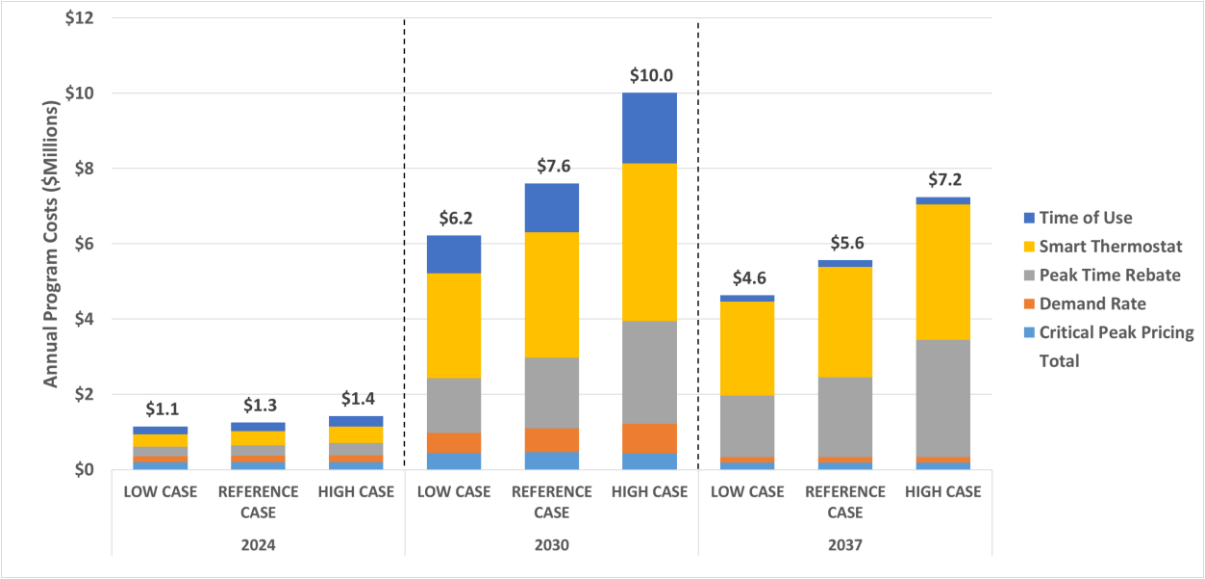
Figure 34: Residential Winter MW Peak Savings for selected years, by Program and Scenario



Program Costs and Cost-effectiveness

Figure 35 shows the real costs for selected years for the residential programs over a 15-year program life, while Table 18 shows the cost-effectiveness ratios and the levelized costs for the programs.

Figure 35: Residential Achievable Reference Case Annual Costs for Select Years



In the reference case, all the programs have a TRC ratio close to over 2.0. The overall sector level portfolio clears TRC at 3.1.

Table 18: Residential Achievable Reference Case Cost-Effectiveness Ratios and Levelized Costs

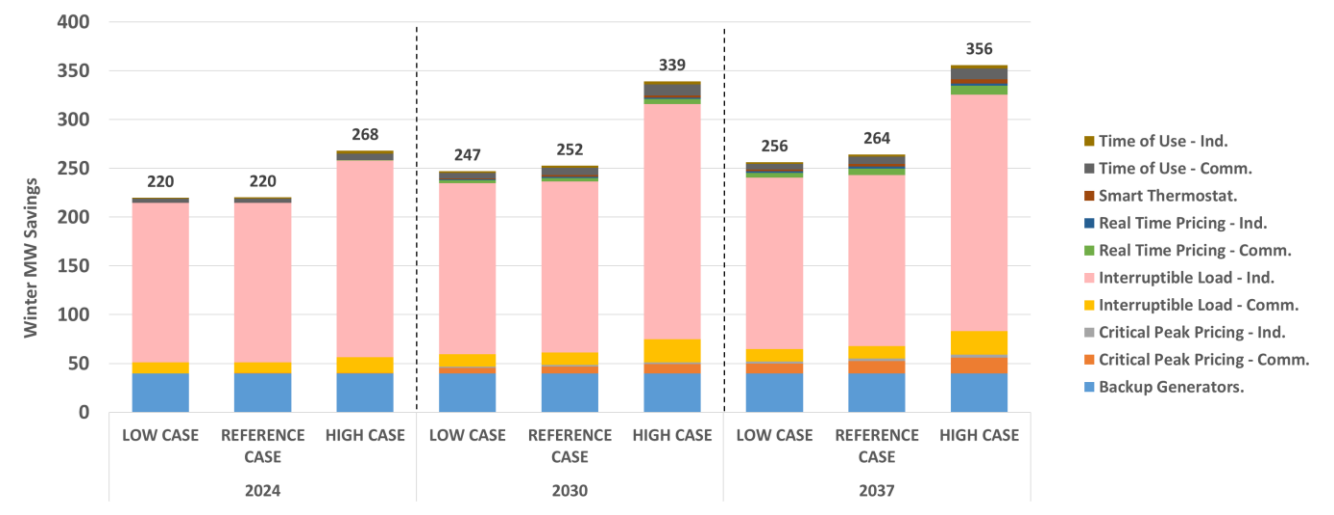
Program	Low		Reference		High	
	Benefit-Cost Ratio	Levelized Cost	Benefit-Cost Ratio	Levelized Cost	Benefit-Cost Ratio	Levelized Cost
Critical Peak Pricing	3.2	$ 27	3.4	$ 26	3.1	$ 29
Demand Rate	1.7	$ 51	1.9	$ 47	2.1	$ 42
Peak Time Rebate	3.3	$ 73	3.8	$ 70	4.4	$ 66
Smart Thermostat	2.4	$ 64	2.6	$ 61	2.9	$ 58
Time of Use	3.7	$ 24	3.9	$ 22	4.2	$ 21
Total (Residential Portfolio)	**2.8**	**$ 49**	**3.1**	**$ 47**	**3.4**	**$ 45**

3.6.3 C&I Results

Demand Savings

Figure 36 shows the C&I savings potential by program, for specific years, for the low, reference and high cases. Savings are estimated to reach 264 MW in the reference case and 356 MW in the high case by 2037. Among the C&I programs, interruptible rate remains the highest contributor through 2037, with a share of 72% of the total C&I MW savings.

Figure 36:Commercial and Industrial Winter MW Peak Savings for selected years, by Program and Scenario



Program Costs and Cost-effectiveness

Figure 37 shows the real costs for selected years for the residential programs over a 15-year program life, while Table 19 shows the cost-effectiveness ratios and the levelized costs for the programs. In the reference case, the overall sector level portfolio clears TRC at 20.1, mainly due the high TRC value of the Interruptible program.

Figure 37: C&I Achievable Reference Case Annual Costs for Select Years

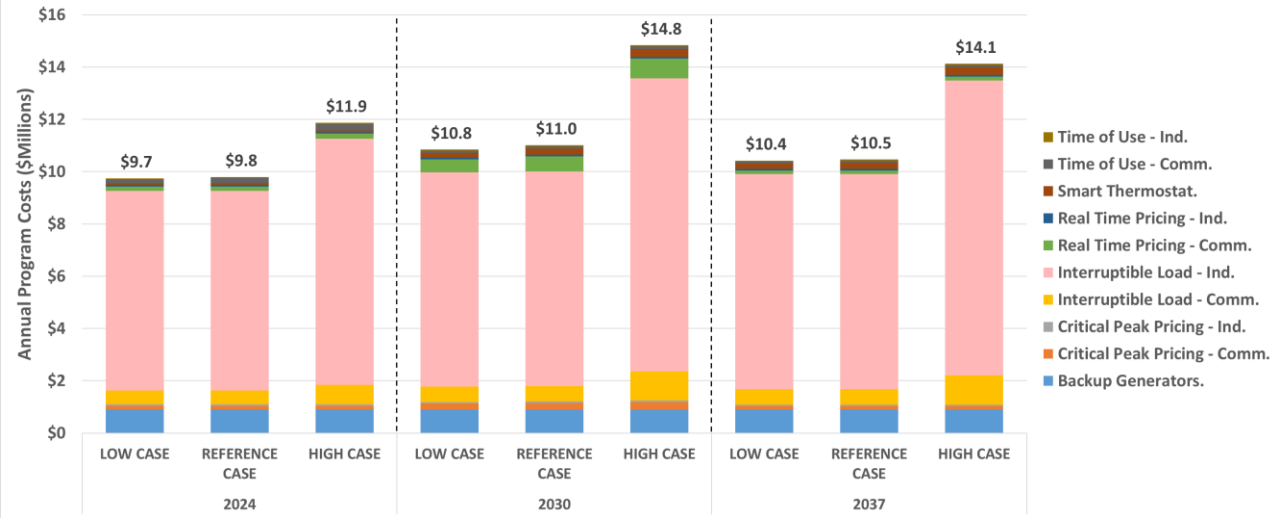


Table 19: C&I Achievable Reference Case Cost-Effectiveness Ratios and Levelized Costs

Program	Low		Reference		High	
	Benefit-Cost Ratio	Levelized Cost	Benefit-Cost Ratio	Levelized Cost	Benefit-Cost Ratio	Levelized Cost
Backup Generators	NA	$ 23	NA*	$ 23	NA	$ 23
Critical Peak Pricing-Comm.	2.4	$ 36	2.8	$ 31	3.4	$ 26
Critical Peak Pricing-Ind.	1.4	$ 65	1.6	$ 54	1.8	$ 49
Interruptible Load-Comm.	85.2	$ 47	85.2	$ 47	146.6	$ 46
Interruptible Load-Ind.	86.7	$ 47	86.7	$ 47	115.5	$ 47
Real Time Pricing-Comm.	0.7	$ 122	0.8	$ 109	0.9	$ 96
Real Time Pricing-Ind.	0.8	$ 110	1.0	$ 87	1.4	$ 63
Smart Thermostat	0.9	$ 146	1.2	$ 128	1.5	$ 110
Time of Use-Comm.	4.4	$ 20	4.9	$ 18	5.8	$ 15
Time of Use-Ind.	3.0	$ 29	3.7	$ 24	6.7	$ 13
Total (Residential Portfolio)	21.2	$ 43	20.1	$ 43	23.5	$ 43

* Benefit-cost ratio for backup generators was not estimated

3.6.4 Opt-Out Results

Opt-out results refer to the scenarios in which Time of Use program was modeled with a delivery mode of opt-out, and the rest of the programs were maintained to be opt-in. In the reference case for opt-out, DR programs have the potential to reduce load at the time of the forecasted winter peak demand by 11% by the year 2037, which amounts to 561 MW. Figure 38 shows the trend of savings across the study period for the three scenarios.

Figure 38: Savings Across the Study Period, by Scenario

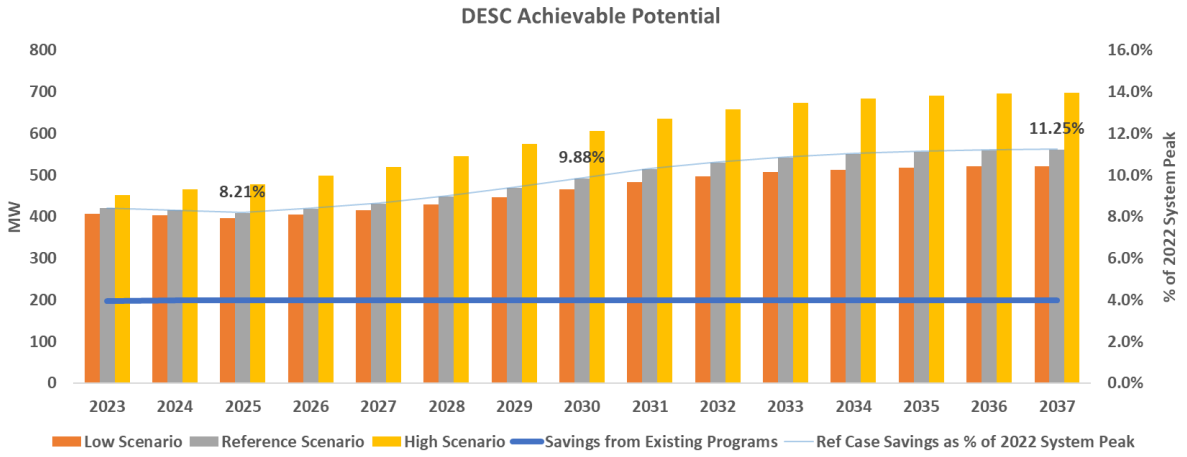


Figure 39 shows the percentage savings of peak demand of each sector, by scenario, that can be reduced from the DR programs. There is a slightly higher contribution from the residential compared to the C&I sector towards the end of the study period, due to the opt-out nature of the time of use program in residential that contributes significantly compared to the residential peak.

Figure 39: Percentage Winter MW Peak Savings Split by Sector & Scenario for 2037

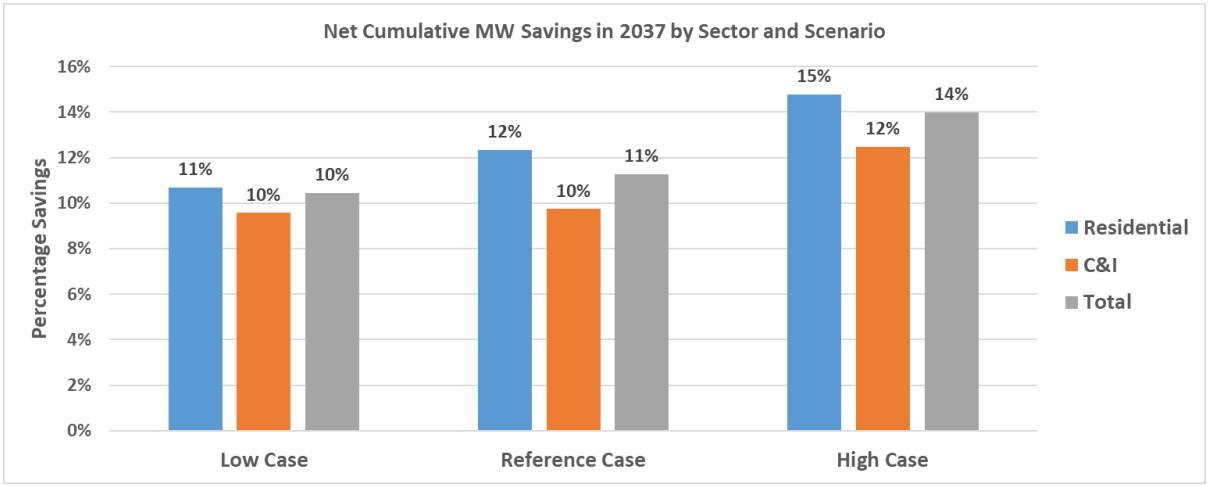


Figure 40 shows the savings contribution from the sectors, which follows a similar pattern to that of the opt-in reference case, albeit slightly higher savings.

Figure 40: Baseline and Savings Split by Sector & Scenario for 2037

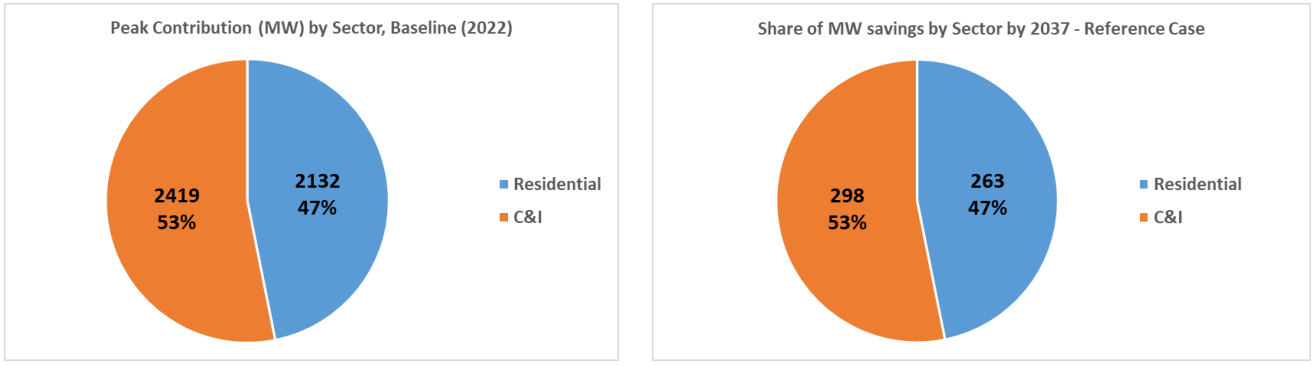


Figure 41 shows the real costs that will be incurred for running the programs in the reference scenario in each year.

Figure 41: Annual Program Costs Split by Sector for Achievable Reference Scenario

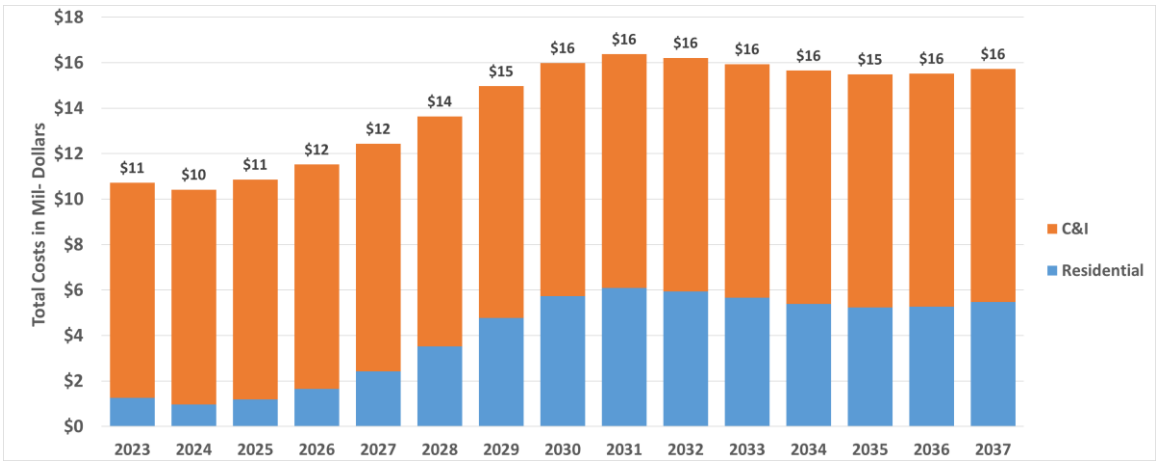


Figure 42 and Figure 43 show the program savings contribution, for the residential and C&I sectors.

Figure 42: Residential Winter MW Peak Savings for selected years, by Program and Scenario

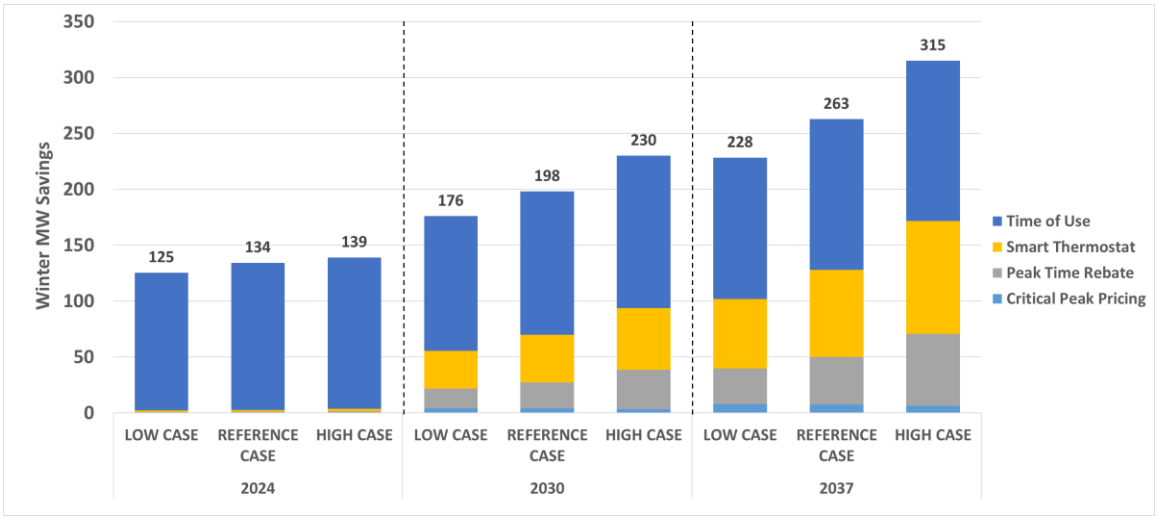
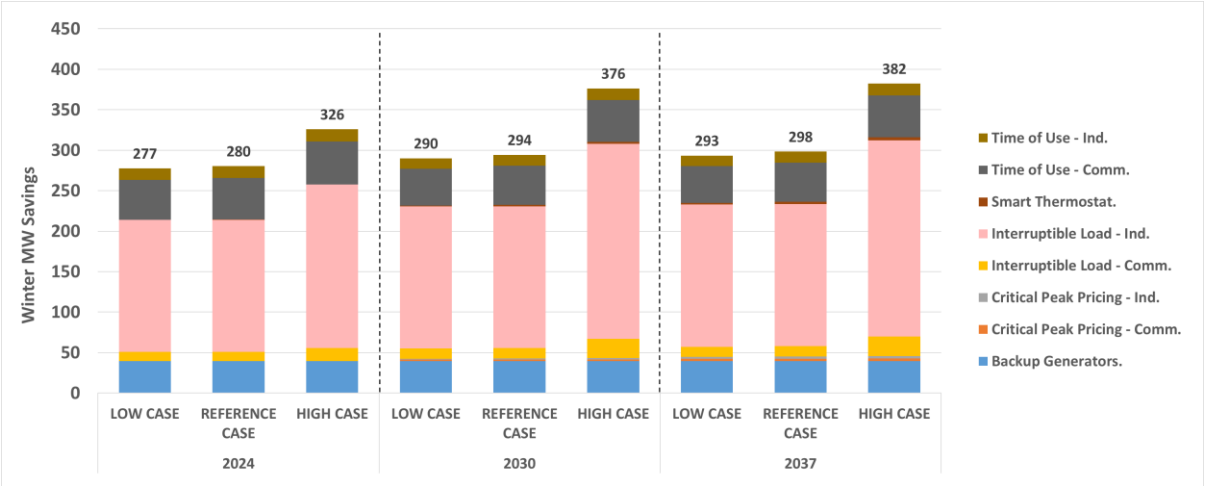


Figure 43: Commercial and Industrial Winter MW Peak Savings for selected years, by Program and Scenario



For the sake of completeness, the stand-alone maximum achievable potential results and detailed results for the opt-in and opt-out options are provided in the Appendices.

3.7 Key Findings

Key findings from the DR potential study, for the scenario where all programs are rolled out as opt-in, are as follows:

- Demand response programs have the potential to shave ~10% of the peak load, by 2037, in the reference case. This numbers goes up to 13% in the high case and can dip down to 9% in the low case. The corresponding MW savings are 486 MW, 653 MW and 432 MW for the reference, high and low cases.

- Existing programs - interruptible and backup generation - contribute to 47% of the total savings even in 2037. In 2037, 39% of savings are achieved from the interruptible program, 8% of savings are achieved from the backup generation program, in the reference case.

- Among the new programs, smart thermostat, time of use and peak time rebates are the highest contributors. In 2037, in the reference case, these three programs contribute to 15%, 13% and 9% of the total savings estimated from the demand response programs.

- Smart thermostats contribute 34% of the overall residential savings, followed by 28% from the time of use residential program. In the reference case, the contributions from the other programs (i.e., peak time rebate, critical peak pricing and demand rate stand at 19%, 12% and 7%, respectively)

- Interruptible program contributes to 72% of the total C&I savings, followed by the backup generation program that contributes to 15%. All the other programs have single digit percentage contributions adding up to 13%.

- The portfolio level cost-effectiveness (i.e., TRC) over a 15-year period is 7.9. In all sectors, all programs except the real-time pricing have TRC benefit-cost ratios greater than 1 in all cases.

APPENDICES

A. Energy Efficiency: Measure Assumptions

Residential Assumptions

DESC Potential Study - Measure Characteriz

Commercial Assumptions

DESC Potential Study - Measure Characteriz

Industrial Assumptions

DESC Potential Study - Measure Characteriz

B. Energy Efficiency: Technical and Economic Potential Results

DESC Potential Study - Technical & Econom

C. Energy Efficiency: Achievable Potential Results

DESC Potential Study - Achievable Results.x

D. Energy Efficiency: Commission-Required Forecast Results

DESC Potential Study - Commission-Require

E. Demand Response: Opt-in Results

Demand response result for the scenario where Time of Use program is modeled as opt-in along with all the other programs.

DESC Potential Study - Achievable R

F. Demand Response: Opt-out Results

Demand response results for the scenario where Time of Use program is modeled as opt-out while all the other programs are modeled as opt-in.

DESC Potential Study - Achievable R

G. Demand Response: Stand-Alone Maximum Achievable Results

Demand response results for the programs modeled as stand-alone, with participation set to high case scenario participation. These results are not additive and hence there are no portfolio numbers.

DESC Potential Study - Achievable R

H. Avoided Costs

Avoided energy and capacity costs in real dollars.

Year	Residential Avoided Costs						
	Energy						Capacity
	Lighting	Heating and Cooling	Cooling	Water Heating	Refrigeration	Whole Home	
	$/MWh						$/kW
2023	50.54	52.46	55.36	48.79	48.75	51.08	72.84
2024	51.56	53.51	56.47	49.76	49.73	52.10	72.84
2025	52.59	54.58	57.60	50.76	50.72	53.14	72.84
2026	53.64	55.68	58.75	51.77	51.74	54.21	72.84
2027	54.71	56.79	59.93	52.81	52.77	55.29	72.84
2028	55.81	57.92	61.12	53.86	53.83	56.40	72.84
2029	56.92	59.08	62.35	54.94	54.90	57.52	72.84
2030	58.06	60.26	63.59	56.04	56.00	58.67	72.84
2031	59.22	61.47	64.87	57.16	57.12	59.85	72.84
2032	60.41	62.70	66.16	58.30	58.26	61.04	72.84
2033	61.61	63.95	67.49	59.47	59.43	62.26	72.84
2034	62.85	65.23	68.84	60.66	60.62	63.51	72.84
2035	64.10	66.54	70.21	61.87	61.83	64.78	72.84
2036	65.39	67.87	71.62	63.11	63.07	66.08	72.84
2037	66.69	69.23	73.05	64.37	64.33	67.40	72.84
2038	68.03	70.61	74.51	65.66	65.61	68.75	72.84
2039	69.39	72.02	76.00	66.97	66.93	70.12	72.84
2040	70.78	73.46	77.52	68.31	68.27	71.52	72.84
2041	72.19	74.93	79.07	69.68	69.63	72.95	72.84
2042	73.63	76.43	80.65	71.07	71.02	74.41	72.84

Year	Commercial and Industrial (C&I) Avoided Costs						
	Energy						Capacity
	Lighting	Heating and Cooling	Cooling	Water Heating	Refrigeration	Whole Facility	
	$/MWh						$/kW
2023	47.90	52.35	52.56	48.82	44.17	49.41	72.84
2024	48.86	53.39	53.62	49.80	45.05	50.40	72.84
2025	49.84	54.46	54.69	50.80	45.95	51.41	72.84
2026	50.84	55.55	55.78	51.81	46.87	52.44	72.84
2027	51.85	56.66	56.90	52.85	47.81	53.49	72.84
2028	52.89	57.80	58.04	53.91	48.77	54.56	72.84
2029	53.95	58.95	59.20	54.98	49.74	55.65	72.84
2030	55.03	60.13	60.38	56.08	50.74	56.76	72.84
2031	56.13	61.33	61.59	57.20	51.75	57.90	72.84
2032	57.25	62.56	62.82	58.35	52.79	59.05	72.84
2033	58.39	63.81	64.08	59.52	53.84	60.23	72.84
2034	59.56	65.09	65.36	60.71	54.92	61.44	72.84
2035	60.75	66.39	66.66	61.92	56.02	62.67	72.84
2036	61.97	67.72	68.00	63.16	57.14	63.92	72.84
2037	63.21	69.07	69.36	64.42	58.28	65.20	72.84
2038	64.47	70.45	70.74	65.71	59.45	66.50	72.84
2039	65.76	71.86	72.16	67.02	60.64	67.83	72.84
2040	67.08	73.30	73.60	68.36	61.85	69.19	72.84
2041	68.42	52.35	52.56	48.82	63.09	49.41	72.84
2042	69.79	53.39	53.62	49.80	64.35	50.40	72.84

I. Demand Response: Additional Assumptions

Technical Feasibility

Sector	Program - Measure	Technical Feasibility
Residential	Time of Use	100%
Residential	Demand Rate	100%
Residential	Critical Peak Pricing	100%
Residential	Peak Time Rebate	100%
Residential	Smart Thermostat	55%
Residential	Water Heater	71%

Sector	Program - Measure	Technical Feasibility
Residential	Battery Storage	100%
Residential	EV Smart Charger	8%
Commercial	Time of Use	100%
Commercial	Real Time Pricing	100%
Commercial	Critical Peak Pricing	100%
Commercial	Interruptible Load	1.40%
Commercial	Smart Thermostat	72%
Commercial	Water Heater	68%
Commercial	Backup Generators	Existing*
Commercial	Auto Demand Response	0.90%
Industrial	Time of Use	100%
Industrial	Real Time Pricing	100%
Industrial	Critical Peak Pricing	100%
Industrial	Interruptible Load	42%
Industrial	Auto Demand Response	4%

Residential Incentive and Non-Incentive Costs

Program	Incentive Costs ($/participant)		Non-Incentive Costs ($/participant)	
	One Time	Recurring	Equipment + Installation	Marketing/ Recruitment
Time of Use	NA	NA	NA	$25
Demand Rate	NA	NA	NA	$50
Critical Peak Pricing	NA	NA	NA	$50
Peak Time Rebate	NA	$13	NA	$25
Smart Thermostat - BYOT	$80	$25	NA	$40
Smart Thermostat - DI	$0	$25	$240	$40
Smart Thermostat - DIY	$50	$25	$120	$40
Water Heater	$50	$35	$300	$40
Battery Storage	NA	$225/kW*	$12,500	$50
EV Smart Charger	$100	$50	$968	$50

*Battery Storage incentives are provided per kW of load shifted

Commercial Incentive and Non-Incentive Costs

Program	Incentive Costs ($/participant)		Non-Incentive Costs ($/participant)	
	One Time	Recurring	Equipment + Installation	Marketing/ Recruitment
Time of Use	NA	NA	NA	$50
Real Time Pricing	NA	NA	NA	$350
Critical Peak Pricing	NA	NA	NA	$50

Program	Incentive Costs ($/participant)		Non-Incentive Costs ($/participant)	
	One Time	Recurring	Equipment + Installation	Marketing/ Recruitment
Interruptible Load	NA	$ 4.5/kW per month	NA	$80
Smart Thermostat - BYOT	$80	$50	$ -	$40
Smart Thermostat - DI	NA	$50	$240	$40
Smart Thermostat - DIY	$50	$50	$120	$40
Water Heater	$50	$35	$300	$40
Backup Generators	NA	$ 2.25/kW per month	$ -	$ -
Demand Response	NA	$47	NA	$40

Industrial Incentive and Non-Incentive Costs

Program	Incentive Costs ($/participant)	Non-Incentive Costs ($/participant)
	Recurring	Marketing/ Recruitment
Time of Use	NA	$50
Real Time Pricing	NA	$350
Critical Peak Pricing	NA	$50
Interruptible Load	$ 4.5/kW* per month	NA
Auto Demand Response	$2.5/kW per month	$25